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ABSTRACT

This report presents case studies on the use of satellites for education in five Commonwealth countries: Australia, Canada, India, Fiji, and Jamaica. Information provided in each of the case studies includes geography, production, the distribution system, regulation and management, and costs. Additional information given for the Australian National Satellite, AUSSAT, covers earlier projects; target groups and educational objectives; programing and teaching; utilization; planned projects; and evaluation, outcomes, and expected changes. Fourteen references are listed. Additional information on the Knowledge Network, a provincial educational communications authority in British Columbia, includes audiences; patterns of communication; and transmission and reception. The case study on INSAT, an Indian national satellite, also provides information on educational needs; earlier projects; target groups and educational objectives; programming; and patterns of communication. The description of the University of the South Pacific (Fiji) satellite project also covers earlier projects; target groups and educational objectives; programming; patterns of communication; utilization; duration; and evaluation findings. Four references are listed. Information provided on the satellite project of the University of the West Indies (Jamaica) also includes earlier projects; target groups and educational objectives; programming; patterns of communication; utilization; duration; and evaluation findings. Seven references are listed. (MES)

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Educational Information Technology Associates

SATELLITES FOR COMMONWEALTH EDUCATION: SOME POLICY ISSUES

A study commissioned by the Commonwealth Secretariat

Case studies

AUSSAT, Australia

Knowledge Network, Canada

INSAT, India

University of the South Pacific

University of the West Indies

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c Commonwealth Secretariat

EDUCATION AND THE AUSTRALIAN NATIONAL SATELLITE: AUSSAT

1.Brief project description

The Australian National Satellite Company AUSSAT Pty Ltd, which became operational in late 1985, provides communication services on a commercial basis via two Ku Band satellites (A1/ A2) for television, radio, audio, and data services. Each satellite has eleven low power (12 watt) and four medium power (30watt) transponders. The latter when deployed in regional spot beams provide a quasi DBS known as the Homestead and Community Broadcasting Satellite Service (HACBSS). A third satellite (A3) with extended capacity to cover the South-West Pacific was launched on 16th September 1987. The AUSSAT system of satellites includes both national and regional beams. A1 and A2 have the switching capacity to receive and transmit services to and from Papua New Guinea but the latter service is currently unused. Over-spill of some existing Australian satellite television services has been reported in both Papua New Guinea and New Zealand. Australia is the first country to introduce a national satellite system on a purely commercial basis although there is ongoing public debate about the economic viability of the system.

Educational services are currently carried via AUSSAT, either as part of existing broadcast delivery services, or as a component of new State Government 'closed user group' communication networks.

The aims of existing educational users of AUSSAT include:

a) to extend the reach and range of national television educational services, including telecourses;

b) to provide enhanced regional broadcast and point-to-multipoint educational services on a State basis;

c) to evaluate the costs and benefits of expanded interactive audio, video, and data services for education and training in isolated and remote areas.

2. Geography

Australia has land mass of 2.9 million sq. miles with a relatively small and multicultural population of approximately 16 million people. Seventy per cent of the population is concentrated in twelve urban locations on the eastern seaboard. The majority of the indigenous Aboriginal population (250,000) live outside the latter south-eastern population centres in regional or remote communities in northern and central Australia.

Prior to the introduction of AUSSAT it was estimated that approximately 300,000 people were beyond the reach of the Australian Broadcasting Company's (ABC's) national television service. Similarly, at that time, Telecom planned for an additional 35,000 Rural and Remote Area Services to be established by 1990. For instance, the community of Doomadgee, in Queensland, with a mainly Aboriginal population of about 1,000, had no public telephone service, or local radio broadcast service, before the provision of a satellite service. (It should be noted, however, that Telecom's emphasis in the provision of basic telecommunications

services to remote Australia is on terrestrial extension. It does not see these services being provided by satellite, essentially on cost and technical grounds.)

3. Earlier educational satellite projects

Previous practical experience of dedicated educational satellite projects was limited to some institutional use of NASA's ATS-1 and ATS-3 based PEACESAT for voice communications and experimental data links with educational centres in the Pacific region. Historically, however, terrestrially based Australian distance education services included several examples of electronic communication and distribution systems including HF radio, videocassette systems, and some broadcast and telecommunication services.

Terrestrial trials of interactive educational services continue, and it is planned to include satellite link components in the future development of some of these services where it can be justified on economic grounds.

4. Target groups and main educational objectives

All current educational satellite services are being carried on AUSSAT in one of three ways:

a. in association with other State Government satellite communication service offerings on a *dedicated closed user Government network* (eg: Queensland);

b. as part of an *integrated public broadcast service* (eg: National, and Regional Western Australia);

c as a part of a *combined State network and an integrated broadcast service* (e.g: Western Australia).

Target groups and objectives by region are as follows:

4.1 Queensland

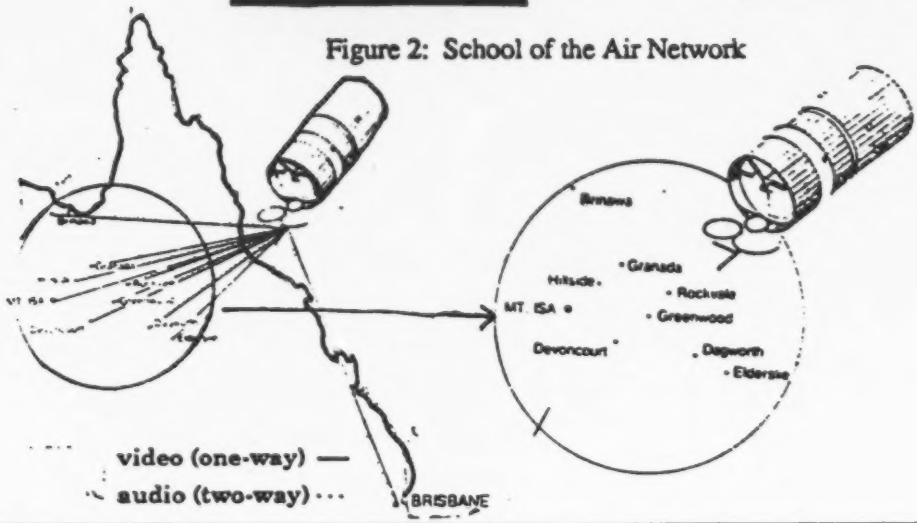
All educational trials are conducted via the State Government Q-NET system operated by the Department of Industry and Development. Q-NET trials to date include the following:

Q-NET School of the Air (SOTA) Trial

The target group is thirteen primary school children in separate, isolated locations served by a satellite star network from the Mt Isa School of the Air (see Figures 1 and 2). Each remote site is provided with two-way voice and data facilities, plus television reception. The objective is to evaluate a range of teaching strategies, and the system configurations and costs required for *home delivery of primary education* via satellite The pilot is operated in parallel with the existing High Frequency SOTA radio network. (Queensland Department of Education, 1987)

Figure 1: School of the Air Workstation

Figure 2: School of the Air Network



TAFE Q-NET

This development grew out of trials in late 1986, which examined vision, sound and data applications of satellite technology at South Brisbane and a number of other TAFE (Technical and Further Education) colleges throughout the State. These trials provided the basis for development of a network which now transmits some 10 hours of programmes per week. This network, known as TAFE Q-NET, has 26 major sites at TAFE Colleges and TAFE Centres around Queensland. The network is administered by the School of Electronic Media Studies under the direction of Roy O'Malley, Officer-in-Charge.

The target group is *secondary and post-secondary external students in award courses in colleges and TAFE centres throughout the state.*

Television lectures and course materials are delivered from the South Brisbane TAFE School of Electronic Media Studies, and are used in combination with audio teleconferencing. An example of the courses offered is Horse Care and Management, targeted at remote cattle stations, horse owners, and members of the horse breeding industry.

Central Film Library Access

The target group is *regional schools* throughout the state. The reason for using the satellite is to overcome delays in accessing Queensland Education Department materials in high demand. Selected film and video programmes are downloaded to sixteen regional sites for subsequent syndication to 212 schools.

Tertiary and Professional Development

Brisbane College of Advanced Education uses Q-NET to reach *regionally based continuing education students teachers and librarians* throughout the state. The Department of Health puts on courses for *nurses and staff in country hospitals and health centres*, particularly in the remote Gulf of Carpentaria region, as part of the North-West Telemedicine Project. The service offers on-site training, and central database access to medical procedural information.

The Queensland Department of Education, through its Early Literacy In-service Course (ELIC), is trialling one model of distance learning made possible by Q-NET. These trials have provided important feedback on the value and implications of the *telecourse* model, and also on Q-NET as a delivery system to facilitate *in-service training for teaching personnel scattered across the State*. The ELIC Telecourse involves groups of up to ten teachers meeting at Q-NET sites around the state for eleven weekly sessions. The 1986 trials involved 120 teachers. Trials are continuing throughout 1987 to refine the model, to learn more about its application, to explore this particular use of Q-NET and to assist teachers in non-metropolitan areas undertake professional development.

Q-NET Health Care Applications

The North-West Telemedicine Project enhances communications between *primary health care providers in remote towns* around the Gulf of Carpentaria. Mt Isa Base Hospital is the hub of the network.

West Australia

The West Australian Government consideration of the full scale 1986 WESTNET proposal was deferred earlier this year. However, elements of the proposal are still under consideration and an *Educational Television Service* broadcast throughout the State via satellite commenced in October 1986.

Western Australia Educational Television Service (WE ED TV)

The WA ED TV Service is provided under an agreement between the State Government of Western Australia and the Golden West Network (GWN), a licensee of WA Remote Commercial Television Service. GWN is committed to broadcast fourteen hours per week of educational television programming (GWN, 1987). This is currently scheduled with two hours each weekday, and four hours on Saturdays. The primary audience is 500 *regional and remote schools*, and 2000 *students in Distance Education Centres*. The secondary target groups are those engaged in *professional development courses, and also the general public.*

The service aims to improve the efficiency and effectiveness of educational offerings in

regional and remote areas, with specific programming objectives determined by the institutional provider. Tertiary institutions provide a significant amount of enrichment programming for corporate relations purposes. Development of parental awareness is also viewed as a high priority given the small and isolated nature of many of the state's communities now able to receive the ED TV Service.

National

Learning Network

Learning Network commenced operations in March 1987 offering a range of *telecourses* on ABC National Television and the Special Broadcasting Service (SBS) Multicultural Television Service. The Learning Network acts as a brokering service at a national level between participating institutions offering educational courses and satellite based broadcast delivery systems. AUSSAT makes it possible for anyone in Australia to receive telecourses via the ABC. All metropolitan areas except Darwin can also receive courses via the SBS. Sixteen educational institutions including Universities, CAE's and TAFE Colleges participated in the first seven courses transmitted to students enrolling through their respective institutions. Initial courses included: The Business of Hospitality; The New Literacy: An Introduction to Computers; The Business of Management; Basic Electricity & DC Circuits; Marketing; Faces of Culture; Greek Elderly Health.

5. Production, programming and teaching

Queensland

School of the Air

Each 'learning package', delivered by mail, contains a selection of student workbooks, fiction and non-fiction print resources, audio and video cassettes, and computer programmes. A live television programme is broadcast from the Department of Education studio in Brisbane fortnightly. The programme uses the voice system to link the 13 students to the studio presenters and guests appearing in the programme. All class members can talk, exchange ideas and opinions, take part in decision-making, plan tasks and take responsibility for their own learning programmes. Computer software is integrated into the curriculum By switching the communication channel to transmit data instead of voice allows computer text and graphics to be sent between the students and the teacher. This enables the teacher to plan, construct and transmit screens of information to the students' computers. Tasks set and completed on the computer can be exchanged between student and teacher, and sent and received in minutes instead of the weeks normally required to make the same journey by conventional mail services. The computer has also facilitated the process of writing through the use of word processors, has enabled students to manipulate computer simulations, and has allowed students to test hypotheses and draw conclusions through access to data-bases.

TAFE-Q-NET

The School of Electronic Media Studies in Brisbane was established on January 27, 1987, both to implement the satellite television and data network and to provide a focus for media-based areas of teaching. The school, sited at South Brisbane TAFE, has extensive TV production

facilities. These include a new Aus$4 million (£1.76 million) studio equipped to full broadcast standards with chroma key, cyclorama backdrops, auto cue, computer-controlled cameras and editing equipment, as well as graphics, animation, photography and outside broadcast facilities. With all facilities now on line broadcast hours are expected to rise to more than 30 hours per week by late 1987. The second semester of 1987 will also see extensive trialling and refinement of the data network expected to be operational by the end of 1987.The school itself has 28 staff with expertise in Education, Radio and Television Broadcasting, Graphic Design, Photography and Educational Technology.

A major strength of the network is the Regional Co-ordinators at each site. Co-ordinators are responsible for course publicity and the management of satellite resources at each location. As they are also aware of community attitudes and sensitive to local needs, they have responsibility for keeping the school informed of specific community requirements.

Tertiary and professional development

Programme production and teaching strategies in this sector are the responsibility of the educational institutions providing the programmes This means providing or using appropriate facilities at each site.

Brisbane College of Advanced Education presents an average of six hours per week of live one way video, for its in-service teacher training courses, with students connected to the studio via the public switched telephone network. For instance, the Annual Economics School has a one-off special five hour interactive program for several thousand students and teachers of economics.

The Family Medicine Programme (FMP) combines satellite and terrestrial communications to provide one-way video and two-way audio between Brisbane and country centres. Participants are shown video tapes of operations and surgical procedures. Slide and graphic material, practical demonstrations and role play are also included in the sessions. Clinical problems can be discussed directly with the speaker via a telephone link. This means that comments or discussion about issues are immediately incorporated in the session.

Participants in the weekly ELIC Telecourse workshops watch a video program transmitted via Q-NET. This program is tailored to meet the particular needs and interests of participants through the inclusion of 'You-Asked-For-It' video segments. An important part of the ELIC Telecourse workshops is teleconferencing with tutors. This is conducted at TV-equipped Q-NET sites using Telecom phone lines. In the more remote areas, with inadequate Telecom service, Q-NET has provided phones linked to the State Government Telephone Network.

For the North-West Telemedicine Project, hospitals at Mornington Island, Normanton, and the health care centre at Doomadgee have been equipped with slow scan television, video cameras, VDU's, facsimile machines and conference telephones with which to communicate. Dedicated telemedicine studios are located at Mt Isa and at the Royal Brisbane Hospital for specialist consultations. The facilities allow transmission of X-rays, ultra-sound images, ECG laboratory reports, patient discharge letters and hospital administrative information. The network also serves an educational role. Staff from Royal Brisbane and Mt Isa Hospitals present material on topics such as radiographic techniques, physiotherapy, minor surgical procedures and laboratory practice. The Department of Health is also trialling continuing education for nurses using Q-NET. The programmes have included topics such as alcohol and drug dependency,

children's issues, and AIDS as well as information for skills development and improvement in nursing practice. An important Department of Health project has been the provision of the Manual of Procedures through videotext. This has involved the complete transfer of procedural information to a database accessible through videotext. Terminals at hospitals included in the pilot project allow staff to have access to the latest procedural information.

West Australia

WE ED TV

Programming is selected by a Coordinating Committee representing the Department of Education, the WA Post-Secondary and Tertiary Educational Institutions, and the Catholic Education Office. The Committee meets four times each year to plan each forthcoming term's schedule. Liaison between educational program providers and GWN is organised by the Audio-Visual Services Branch of the West Australian Education Department. The Branch either prepares 1" master tapes for delivery to GWN's uplink facility in Bunbury (100Km south of Perth), or leases a Telecom microwave bearer on an itinerant basis for live programming feeds. School and student participation is via the terrestrial phone network into Perth.

General

Cost factors appear to have so far precluded any significant original production of educational video programs involving a substantial post-production component. The bulk of television programming in each service is either acquired product (sometime re-cut) or live-to-air studio presentations - lectures, demonstrations, and teleconferences. Many Q-NET live presentations are understood to have proceeded on a 'learn by doing' approach, as the intent has been to use teachers and presenters more on the basis of their subject skills rather than their training in the use of the television medium.

6. Distribution system

AUSSAT's first two satellites (A1&A2) were launched by NASA in late 1985. Both are identical in configuration, with eleven 12 watt Ku Band transponders and four 30 watt transponders on each satellite. A beam switching matrix allows a mix of national and regional beams to be selected, and most services are permanently operated in a single mode, either national or regional. There are four regional areas for direct reception of the Homestead and Community Broadcasting Satellite Service (HACBSS) (see footprint map at the end of the case study)

Users may access the satellites in one of four principle ways:

i) Direct through their own earth stations;

ii) via Major City Earth Stations (MCES) and microwave terrestrial tails operated by AUSSAT Pty Ltd in each capital city.

iii) via the public switched network, or Telecom leased lines and Telecom or AUSSAT earth stations;

iv) via third party earth station operators (e.g. Australian Associated Press).

To protect Telecom's common carrier status, however, users are not allowed to re-sell transponder capacity they have leased from AUSSAT to third parties.

Television Services

The ABC, SBS, GWN and Q-NET satellite services utilise the B-MAC transmission system. B-MAC stands for Multiplexed Analog Component type B, and it was chosen for its capability to provide unique addressability of earth stations, enhanced picture quality, and a range of high quality audio and data channels. The disadvantages of B-MAC have proven to be the high cost of the uplink encoders, and a significant domestic equipment failure rate in initial production runs. (Australia was the first country to adopt B-MAC for satellite transmission.)

The majority of educational service audiences outside Queensland currently receive signals via professional quality B-MAC downlinks and terrestrial PAL re-transmission broadcast facilities. Q-NET, however, being a point-to-multipoint delivery system has used a large number of domestic decoders, and at times experienced up to a 25% equipment failure rate.(The latter partly attributed to the harsh environmental conditions experienced in northern Australia.) Prior to AUSSAT launch the market for domestic decoders was estimated to be 25-30,000 units. Three of the four licensed Remote Commercial Television Services (RCTS) have still to commence operation, however, and the market penetration of domestic HACBSS terminals in mid 1987 was only approximately 10% (ie: approximately 3000 units). Current production runs are expected to overcome many of the problems of earlier 'untried' domestic terminals.

In Queensland the television component of Q-NET services is uplinked via the AUSSAT MCES in Brisbane and downlinked via up to 65 B-MAC decoders at Government, education, health centres and student sites (e.g. SOTA) throughout the state. An additional 1000 domestic receivers have been given access on a 'test-key' basis. The School of the Air reception system includes, as well as the quite large (3.7m) TV receive/voice and data transmit antenna, a microcomputer, a printer, a colour monitor, and special furniture. Because of the need to secure firmly such large antenna in an area subject to high winds, installation costs (though not given) are substantial.

In Western Australia programmes are delivered to GWN's uplink facility at Bunbury, south of Perth, and downlinked to B-MAC /PAL decoders and terrestrial transmitters located in the majority of WA regional communities with populations greater than 500 people. Approximately 1300 other isolated sites including schools can receive the signals direct via HACBSS terminals. The GWN commercial television transmission is encoded and only made available to domestic locations outside the Perth metropolitan area. Metropolitan educational institutions, however, are also allowed to receive the educational programs via HACBSS receivers.

The national Learning Network service is compiled on tape and delivered to the ABC and SBS Sydney for transmission via the AUSSAT MCES. The ABC timeshifts its programming for each time zone. The majority of the population receives the service via the ABC terrestrial transmitters, and all HACBSS receivers are also enabled to receive ABC programmes. The SBS, however, operates a satellite television program service only to its own terrestrial transmitters via a 12watt transponder in the South-east AUSSAT Spot Beam. The SBS B-MAC signal is encoded and not made available to domestic HACBSS terminals despite its

technical capacity to serve many locations in this manner. SBS television serves state capital cities plus Canberra (the national capital) and some regional centres. It is the only main terrestrial channel currently operating on the UHF Band, and suffers from poor reception in a number of its service areas.

Audio

Q-NET is the only service providing regular two-way audio links via *satellite* between isolated students and their teacher. Elsewhere, Q-NET uses hybrid satellite-terrestrial audio circuits (TV and voice out by satellite, voice return by the public switched telephone network or the Queensland Government's private telephone network.). Until June 1987 Q-NET was configured as two companded FM Single Channel Per Carrier (SCPC) star networks, with a regional hub at Mt Isa for SOTA, and the main network hub at the Department of Industry and Development in Brisbane. All audio links are handled by one or other of these centres, with Q-NET PABX's located at outlying centres. Q-NET's potential for voice and data use is now being expanded.

In Western Australia interactive trials using the public switched telephone network have been used to support remote participants.

The national Learning Network has not yet used audio teleconferencing for other than inter-institutional management purposes.

Data

A number of computer communication software tools have been developed to enhance Q-NET student-teacher interaction in the SOTA trial. Central database access is expected to develop more fully on an operational basis. A third packet switched digital star network using spread spectrum and Very Small Aperture Terminal (VSAT) technology is now being added to the Q-NET system. While primarily intended for data communications, the VSAT's will also have a capacity to be used for audio services. It is too early to evaluate the outcomes of the VSAT trials.

Also under consideration by Q-NET is data use of the four 200 kbt/s Q-NET ancillary B-MAC channels. The multiplexing of these channels would allow each of the latter to transmit approximately ten independent 9600 bt/s data streams to computers and peripheral devices. In B-MAC broadcasting services these channels can alternatively carry stereo radio transmissions.

7. Ownership, regulation and management

AUSSAT Pty Ltd is a company owned 75% by the Federal Government and 25% by the Australian Telecommunications Commission (Telecom). The Satellite Communications Act (1984) regulates aspects of the Company's operations and provides that AUSSAT's primary objective is to operate a communications system for Australia in accordance with sound commercial principles. The Act and the Company's Memorandum and Articles also enable AUSSAT to provide communications services for neighbouring regions.

Satellite broadcast (HACBSS) services are limited to the ABC and licensees of the Remote Commercial Television Service (RCTS), the Remote Commercial Radio Service (RCRS), and

the Remote Public Radio Service (RPRS). The Broadcasting Act (1942) regulates the operation of commercial and public broadcasting licences. (Only two satellite direct broadcasting services are currently operational, the ABC and the GWN RCTS.) Satellite Program Service (SPS) Licences and Video, Audio, Information and Entertainment Service (VAEIS) licences issued under the Radiocommunications Act (1983) provide for point-to-multipoint distribution services, and exclude reception of such services in domestic premises.

Both AUSSAT Pty Ltd and Telecom own their own earth station facilities and offer a flexible range of services to satellite users. Telecom controls interconnection with its terrestrial public switched telephone network (PSN). However, all satellite users may elect to establish their own satellite ground stations and private network facilities.

Q-NET operates as a mixed terrestrial/space network with the Government closed user group satellite network interconnected to the PSN, leased line terrestrial tails, and mobile communications services. The Q-NET education trial projects are the responsibility of the participating educational organisations who choose and acquire program rights on a case by case basis. Coordination and network management was provided by the network owner, the Queensland Department of Industry and Development, but the state government sold Q-NET to the Parry Corporation during the course of the case-study.

The WA ED TV Service uses time and facilities made available by a commercial broadcaster, the Golden West Network (GWN). GWN has publishing responsibility for the programming, and may also exercise its rights to re-schedule education programmes according to its broadcasting priorities (e.g. to accommodate live coverage of major sporting events, etc.) Institutional members of the the WA ED TV Coordinating Committee acquire rights for programmes, and compilation, presentation, and publicity is conducted by the Audio Visual Services Branch of the WA Education Department.

A similar programme provider-broadcaster-broadcaster situation exists for the Learning Network with the ABC and the SBS acting as 'publishers' of the telecourse material.

Satellite delivery of educational programming has put further pressure on an already complicated legal situation regarding off- air recording and duplicating rights. New copyright legislation which should cover these areas is due to be introduced into the Commonwealth Parliament in the latter part of 1987.

8. Audiences and utilisation

Queensland: Q-NET

The Queensland Government has established 60 television reception stations for Q-NET, 30 two-way audio earth stations, 200 VSATs for two-way data communication, and has also integrated its private Government telephone network with connections to more than 10,000 telephones. Some of its services, by special agreement, can be provided to the 1,000 or more privately owned earth stations in the state.

Q-NET School of the Air (SOTA) Trial

This trial so far has been limited to 13 students in remote areas. The limiting factor appears to

be the cost of equipping each student with up-link and receive equipment, and work-stations.

TAFE-Q-NET

While there are 26 TAFE centres linked into Q-NET services, no figures have been located for the actual number of students followingTAFE-Q-NET services.

Tertiary and Professional Development

120 teachers followed the ELIC course in 1986. Figures for other uses in this category have not been located.

West Australia

The total potential audience reach for the satellite based television network is 400,000 people. GWN's surveys indicate the actual non-school based viewing audience for the ED TV Service was approximately 6,000 people at the end of the first six months of satellite delivery.

It can be seen that audience figures are difficult to find at the moment. However, the satellite system is still in its early stages of development, with attention being paid more at this stage to getting services operational, rather than to monitoring their reach.

9. Costs

Even a simple net present day cost analysis of some of the systems components is difficult given the nature and variety of contractual and lease-back arrangements entered into by AUSSAT Pty Ltd, the level of inflation since 1982, escalating launch and insurance costs, and more fundamentally the fact that many external educational, systems management, and resource deployment costs remain unquantified.

AUSSAT Pty Ltd is sensitive to criticisms of the satellite system on cost grounds, and rebuffed one critical appraisal by the Australian Telecommunications Employees Union as 'an example of jam tin economics'. What can be stated is that the cost of the space segment (i.e. three satellites and associated ground control equipment, launch of two satellites, plus launch insurance) at contract stage was estimated by AUSSAT to be A$166M (£73 million) in 1982. Other capital costs for which AUSSAT is responsible (equipment, sites and buildings for the Major City Earth Stations) were estimated to increase this total to A$225M (just under £100 million) in 1982. With allowances for additional broadcasting resources deployed a current estimate would suggest an all up cost of approximately A$480 million (1984 dollars) (£210 million), with the third satellite (A3) just launched on 16th September 1987.

Finance costs for the system are significant. Although AUSSAT is owned by the Federal Government the company is only capitalised to A$100M. The debt to equity ratio is, therefore, high and, at this stage, each transponder would be carrying approximately A$1M (£440,000) in interest charges per year.

The satellite component of Q-NET is estimated to be worth approximately A$11M (just under £5 million) as a going concern, and the SOTA trial system approximately A$1M. A$7 million

(£3 million) was set aside by the Queensland Government for a two-year period to set up the Q-NET experiment. Reception and equipment costs for the SOTA trial are particularly high, at A$70,000 (£30,000) a site., and are considered too expensive to replicate in a fully operational SOTA service. Hybrid satellite-terrestrial audio circuits with education centre conference bridges are perceived as more economically viable, particularly where it has been shown that greater utilisation of existing educational facilities (e.g. TAFE colleges) can be generated when they are used to help aggregate public network use. Sharing educational resources with other public sector users is seen as one way to help off-set the capital and operational costs involved in teleconference network development (Queensland Government, undated).

The satellite and terrestrial transmission links of the Golden West Network incurred an additional capital expenditure estimated at A$3M (£1.3 million).

The ABC has the largest satellite network in the country, but given the small number of hours it devotes to telecourse delivery it is inappropriate to try to relate its system cost to educational service delivery.

A more appropriate measure perhaps (particularly given the 'off- peak' delivery of educational services) for end-to-end delivery would be a range of hourly estimated costs associated with the current types, forms, and schedules of programmes being carried via AUSSAT. These are tentatively estimated to be in the range of A$1,000-$2,400 (£500 - £1,000) per hour for full broadcast quality and availability of TV services (with a premium on regionally specific delivery), rising to an average of A$3,000-$3,500 (£1,300 - £1,500) per hour for multi-point teleconferences (one way video/two way audio).

Educational institutions and public service broadcasters have historically had some difficulty in applying full-cost budgeting to their communications services, and the 'hidden subsidy' available for current trials is evident in the level of educational staff and resource time made available out of existing recurrent budgets and capital facilities deployment (studios, administration, training, and technical support.) The actual extent of this subsidy remains to be identified.

10. Planned projects

Additional Remote Commercial Television Service

A number of educational projects originally planned for delivery in 1987 have been delayed. These include the extension of educational programming via RCTS to the satellite's Central, North East, and South-East zones Given the successful launch of the third satellite the Imparja RCTS is scheduled to commence service delivery to the Central Zone in 1988. This zone includes a substantial Aboriginal population. Similarly, licensees of RCTS in the North-East and South-East zones are waiting for transponder capacity to become available. They are also reviewing recent Federal Government changes to the ownership and control rules for commercial television before making a final commitment to taking up satellite capacity.

A condition of each RCTS licence as imposed by the Australian Broadcasting Tribunal is that:

> 'The licensee shall provide access for the following number of hours of educational programs based on or consistent with established curricula (including primary, secondary,

tertiary and continuing education) to meet the specific educational needs and interests of the population within the service area:

a) during the first and second year of operation - a minimum of 80 hours per year;

b) during the third and fourth year of operation - a minimum of 280 hours per year;

c) during the fifth year of operation - a minimum of 560 hours per year;

The licensee shall take all reasonable steps to ensure that the number of hours referred to above are transmitted using program material from independent, educational and its own resources.'

The Sunraysia Project

While the additional broadcasting services have been delayed, a recent initiative by the Victoria Government suggests that at least one educational project could now be established at an earlier date than originally planned. The Sunraysia Project proposal is expected to benefit from the State Government's decision in March this year to establish a government telecommunications network. The Victoria network is to be operated by a new company, VISTEL Ltd, owned jointly by the State Government and the State Electricity Commission. VISTEL's network will comprise of high capacity links from Melbourne to regional centres throughout the state, a satellite network to cover 200 isolated centres in rural Victoria, and enhanced telephone switching facilities in the Central Business District and regional centres.

The Victoria Government views the network as having the potential to assist in the introduction of its Social Justice Strategy by providing access, equity, participation and empowerment through innovative and enhanced service delivery to the community. Education is seen to be just one of the many services that can be improved. People in rural areas, Aboriginals, people with disabilities, and women are cited as among those who have been denied easy access to education.

The Sunraysia proposal called for the establishment of video and data links between participating colleges in the Sunraysia region, Geelong, and Melbourne and was envisaged as a staged approach to the development of a TAFE college mini-network by allowing each college to develop a number of courses each of which would be uniquely available to the entire region. Achievement of this goal was originally expected to take three to four years. A review of VISTEL's ability to now assist in the rapid deployment of affordable links, however, suggests the original time frame may be halved, and that initial service deployment could commence as early as the first quarter of 1988. The scale of the project is also under review as VISTEL nodes could be close to as many as twenty colleges throughout the State.

VISTEL is currently providing facilities leased from Telecom for TAFE teleconferencing trials, and the full network development will be a joint undertaking with Telecom (cf. Q-NET). Telecom will be allowed the right to install optical fibres alongside Victorian Railway lines as part of its development of the national telecommunications network. The State Government will make a capital contribution equivalent to the cost of a regional network installed for the exclusive use of the State Government. The intent is that Telecom will include within a 'Common Interest Group, all Departments and Agencies discharging a social purpose,' although some work remains to be done in clarifying the definitional status of those tertiary

institutions (for example Colleges of Advanced Education) which are funded by the Commonwealth.

The Sunraysia region itself extends across the Victoria state boundary into NSW and South Australia. While it is the case that both the latter States are known to be considering establishing their own Government networks, the timeframe, terms, and conditions that might apply to VISTEL interconnection remain unclear at this stage.

An initial CTEC grant of $250,000 (£110,000) for capital expenditure has been given to the participating institutions, but among the problems still to addressed is the total level of funds to be made available for course development materials. Sunraysia Project course offerings in the region are expected to have a rural industry emphasis and include: business studies; agricultural courses; the hospitality industry; engineering (including microprocessor control engineering).

The first meeting of the Project Management Commitee is scheduled to be held in September, 1987.

11. Evaluation, outcomes and expected changes

Because of the newness of educational satellite initiatives, there has been very little formal evaluation to date. Most of what follows comes from newsletters and publicity material which understandably present a positive image, since they are published by the public relations departments of the system operators. Nevertheless, certain lessons have clearly been learned.

Q-NET

Evaluation to date of the Family Medicine Programme (FMP), undertaken by the Royal Australian College of General Practitioners, shows the benefit of on-site training which allows doctors to participate in educational activities without travelling long distances. This reduces the cost of travel and accommodation as well as the need for locums. Participants have commented favourably on the interactive facility provided by the satellite and telephone network. One enthusiastic doctor commented that 'it means we can take an active part in the learning process, despite the fact that we're more than 1,000 kilometres away.'

The Queensland Department of Education's Research Services Branch undertook one of only two published evaluations to date of educational services running on AUSSAT. This was a study of the ELIC Telecourse during the 1986 trial period (Glen, 1987). ELIC Telecourse trials have indicated that, in this telecourse model, the role of the tutor or 'teacher', while different from that of a tutor in face-to-face courses, is equally important in facilitating learning. Early personal contact between tutors and participants is critical to the quality of interaction possible through the telecourse. The success of this telecourse program has highlighted the importance of using processes and integrated course materials designed to suit the particular communication medium. Although the ELIC Telecourse drew upon existing face-to-face course materials, it was still a major undertaking to develop the workshop processes, video and print materials specifically for use in this course.

The ELIC Telecourse trials found that as a means of communication audio-teleconferencing is different from face-to-face interaction and person-to-person phone calls. To be most effective, teleconferencing requires the tutor to become aware of the constraints and advantages of the

medium and develop skills in its use. The teleconference experience in the ELIC Telecourse has also highlighted the constraints imposed upon successful teleconferencing by technical and acoustic factors, for instance, the quality of particular types of loud-speaker telephones. While this is not a problem unique to Q-NET, the potential of teleconferencing as a valuable communication tool using Q-NET, requires further development of these facilities. The 1986 trials involved 120 teachers, thus directly benefiting the education of approximately 3000 children in areas of the State which, without telecourse provision, would not have been involved in ELIC for some years, if at all. Through this telecourse program in 1987, the education of a further 4500 children will be enhanced. The Queensland Government claims that the ELIC Telecourse is demonstrating that quality professional development programs can be delivered to places, and on a scale, not possible before the advent of Q-NET. The ELIC Project Team has produced a 15 minute video VHS cassette of the Telecourse program for those seeking further information.

The North-West Telemedicine Project's Director, Dr David Watson, is reported as saying that satisfactory clinical consultations had been possible in both emergency and routine situations. 'The project has already had an impact on the number of aerial evacuations,' Dr Watson said. 'This will help to reduce the substantial costs associated with aerial transport and accommodation for people from isolated areas.' Due to the project's success, the Department of Health has requested it be expanded to include hospitals at Townsville and Cairns. 'These hospitals provide the first point of referral in many areas of health care. Their inclusion in the project should dramatically lift its benefit to the community', Dr Watson said. (Queensland Department of Industry, 1987).

A major change is anticipated in the operations of Q-NET following a Queensland Government decision to sell the satellite component of the network to private enterprise. Some thirty tenders were received, including one from Telecom. The sale to the Parry Corporation was announced on September 14, 1987. (This organisation has extensive media holdings in Australia and is also engaged in the development of new television services in Papua New Guinea.)

WA ED TV

Dean (1987) conducted the other evaluation to date of educational services on AUSSAT. He examined the use of interactive programming, i.e. broadcast programmes where viewers can phone-in with their questions which are answered or discussed live during the programme. The programmes were in GWN/WA Education Department's series called 'Education Talkback', in its RCTS service, outside the Perth metropolitan area. The evaluation indicated that those rural viewers who saw the programmes enjoyed them and appreciated the opportunity to phone in with questions.

General

Although satellite education services have have had an uneven development AUSSAT is now carrying an average of more than 50 hours per week of educational television material, plus a significant level of voice and data trials in Queensland. Individual State Government initiatives with regard to their own communication networks have forced the pace on initial educational trial developments.

Not all existing services are expected to continue in their current form in the long term, but new

initiatives are expected next year, both in association with existing networks (WA and Queensland), and also in Victoria. New networks are planned in South Australia and the Northern Territory.

AUSSAT Pty Ltd is keen to promote educational use of the satellite and offers a 20% reduction in tariff's for educational services. The Company is expected to host a conference on educational service development after deployment of its third satellite later this year. (The AUSSAT contact person regarding Commonwealth co-operation is Mr. Leighton Farrell, Manager Corporate Affairs.)

The educational community is only slowly coming to terms with the advantages and disadvantages of satellite services. Practical experience is helping a systems approach to the relative merits of space and terrestrial systems, and some of the organisational factors involved in new work patterns and institutional arrangements.

12. Conclusions and comments

Prior to the launch of AUSSAT a great deal was written and talked about the potential educational applications of satellite technology in Australia. Much of that writing assumed that the launch of AUSSAT would result in the establishment of dedicated educational satellite networks. In retrospect it is quite clear that educators misjudged the emerging regulatory environment and the commercial reality of satellite communication. The regulatory environment which emerged encouraged existing broadcasters and telecommunications users to make use of AUSSAT, but placed severe restrictions on the emergence of new communication systems, particularly the distribution of television in urban areas. The transmission of DBS television into homes was restricted to the areas of Australia not currently served by existing broadcasters and the only new form of television distribution in urban areas was restricted to public places such as hotels and motels. The emergence of widespread narrow band data communication networks will depend on the development of an affordable ground station technology.

As a consequence educational applications of AUSSAT have been almost entirely conducted as one part of other larger communcations or broadcasting projects. And most frequently these have been State-based and controlled broadcasting or telecommunications systems. (The only truly national application is based on the national network of the ABC and SBS.) No educational projects have developed using dedicated stand-alone systems.

The development of the second generation of satellites will obviously offer new technical possibilities. The vigorous Australia debate about the regulation and privatisation of public communication organisations will also influence future options. The task of educational planners will be to marry the technical options and political possibilities if any new large-scale educational satellite-based projects are to emerge.

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We are grateful to Ross White Associates for providing the information contained in this case-study, and for providing most of the following documentation:

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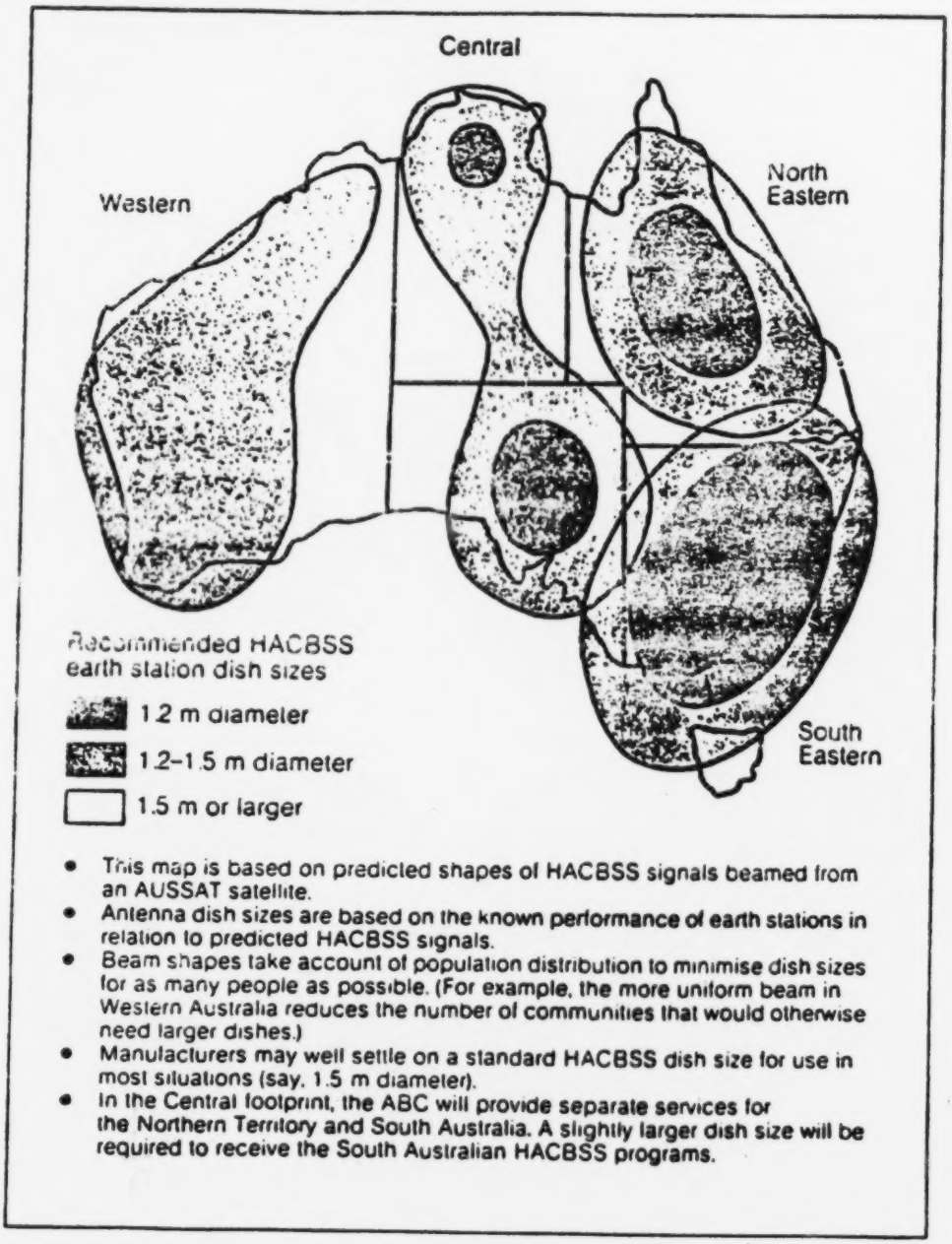
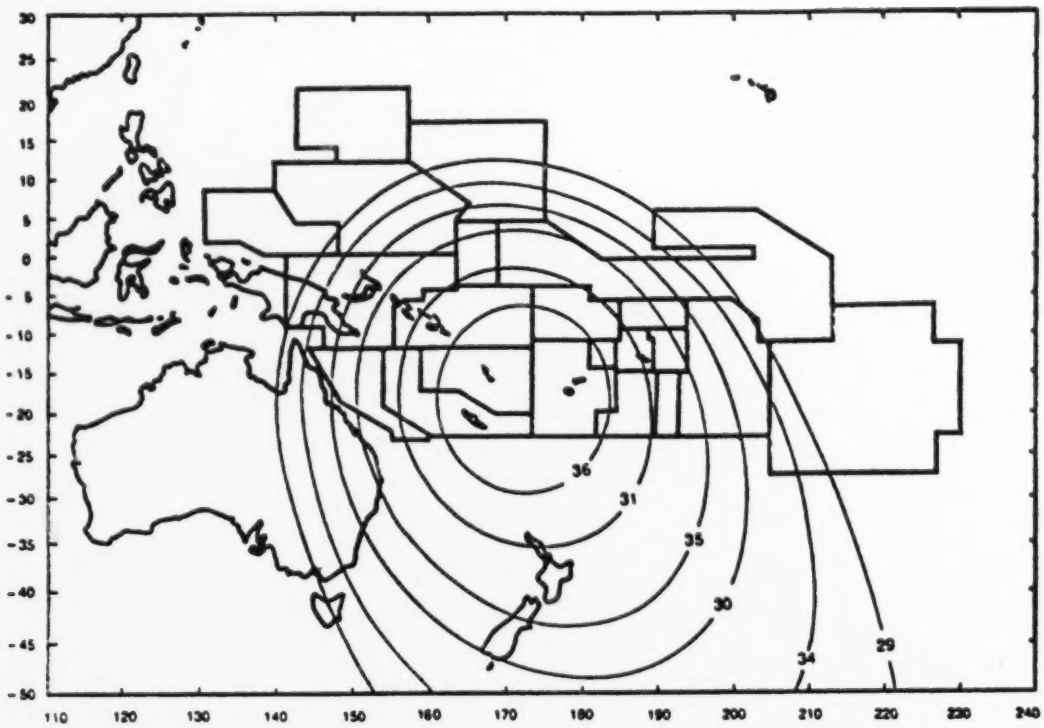
Figure 3: Homestead and Community Broadcasting Satellite Service (DBS) Coverage

The four HACBSS footprints showing recommended dish sizes.



- This map is based on predicted shapes of HACBSS signals beamed from an AUSSAT satellite.
- Antenna dish sizes are based on the known performance of earth stations in relation to predicted HACBSS signals.
- Beam shapes take account of population distribution to minimise dish sizes for as many people as possible. (For example, the more uniform beam in Western Australia reduces the number of communities that would otherwise need larger dishes.)
- Manufacturers may well settle on a standard HACBSS dish size for use in most situations (say, 1.5 m diameter).
- In the Central footprint, the ABC will provide separate services for the Northern Territory and South Australia. A slightly larger dish size will be required to receive the South Australian HACBSS programs.

Figure 4: AUSSAT's South-West Pacific Beam



EIRP for South-West Pacific Beam (dBW)

KNOWLEDGE NETWORK

1. Name of project and brief project description

Knowledge Network is a provincial educational communications authority in British Columbia, in the West of Canada. It acts as an agent for the distribution of television materials for the various educational institutions in the province. Its transmission and advisory facilities are therefore available to any of the regional community colleges, schools, universities, institutes and other public agencies in the province that wish to make and distribute television programmes for educational or informational purposes. Together with the Open Learning Institute, the Universities of British Columbia, Victoria and Simon Fraser University, it is a member of the Open University of British Columbia Consortium. It is the only educational television distribution facility in British Columbia, and uses both the Anik-C satellite and local cable stations for distribution. By law, all cable stations in British Columbia must carry Knowledge Network's programmes.

2. Geography

British Columbia covers an area approximately two-thirds the size of Western Europe, stretching from the Pacific coast to the eastern side of the Rocky Mountains (about 1000 kilometres from east to west) and from the USA border in the south to Alaska and the Yukon in the north.

It has a population of approximately two and a half million, of whom about 80% live in the south-west corner of the province, around Vancouver and Victoria. Despite the concentration of population in the lower mainland, population is scattered right through the rest of the province, since the economy of British Columbia depends heavily on resource-based industries such as logging, mining, fishing and agriculture.

3. Distribution system

Co-axial cable is the main means by which Knowledge Network programmes are received (80% of population are passed by cable). In the lower mainland, where a large number of stations operate, householders need to buy a cable convertor to receive Knowledge Network. In this area, schools are <u>not</u> linked into the local cable service, and are therefore unable to receive Knowledge Network programmes.

Satellite distribution is also used, both to local cable stations and directly to homes via AniK-C, which combines both low-powered and DBS facilities. The footprint covers the whole of the province, as well as a substantial part of Alberta. Many of the isolated homes have large (2.3 metre) dish aerials, to pick up many of the United States entertainment channels, but can also receive Knowledge Network programmes direct in this way. In some areas, programmes are re-broadcast from the satellite link using local low-power ground transmitters.

About 80% of the province's population can receive Knowledge Network i.e. are on the cable and/or have appropriate satellite reception equipment.

Knowledge Network also operates a two-way broad-band cable system linking the Universities of British Columbia and Victoria, Simon Fraser University, several teaching hospitals in Vancouver, and the Law Courts, and within some of these institutions, different locations on campus (see Figure 1). All these generating points have studio facilities and they can communicate directly with each other via full-video, on their own private system. Material from any of these points can also be fed into the public satellite/cable distribution system. However, the broad-band private cable system, although operational for four years, is not used very much, and there is talk of closing it down.

4. Ownership, regulation and management

Anik-C is owned and managed by the Canadian Federal Government, through its Department of Communications, which also regulates broadcasting and cable transmission in Canada.

Knowledge Network is financed by the British Columbian Provincial Government.

Both the satellite and the distribution system then are publicly owned and managed.

5. Main teaching purpose

There are two distinct types of programmes broadcast by Knowledge Network.

Teleseries

Teleseries are public-broadcast programmes which have general educational value and are bought in from other production agencies, such as the PBS system in the USA, TVOntario or even the BBC or ITV companies. These then are very similar to the public broadcasting services of many North American television stations. They may be transmitted without any linked field support, but Knowledge Network has established close links with provincial colleges and voluntary agencies in the public sector, and some of these may decide to run courses based on these Teleseries. An example would be the Jonathan Dimbleby series, 'The Cold War Game', which a local college may decide to use on one of its Politics courses.

Telecourses

The other type are programmes which are part of a fully developed distance teaching package, developed and run by one of the educational institutions. One example is a Simon Fraser Distance Education History course, based on the ITV series, 'The World at War'. This used a bought-in series, and a specially designed set of course books, with full correspondence tutorial backing and assignments, ending with an examination for credit. Another example is a course on fire suppression techniques for the Ministry of Forestry, for volunteer fire-fighters around the province. This consisted of three two-hour live TV programmes and a supporting text.

Educational institutions, as well as producing the telecourses, are also responsible for student enrolment, tuition, credit-giving, and collection of any fees. In 1985,15 colleges, five institutes and three universities provided programme material.

6. Production

Any institution wishing to use the Knowledge Network is responsible for producing and directing its own programmes after consultation with a Knowledge Network adviser. Knowledge Network will hire out a small production facility if required and provides the transmission facilities and technical staff, but does not impose editorial or production control, other than ensuring that users have thought through what they want to do and that the programmes meet miminum technical standards. Apart from the Teleseries, then, it is the responsibility of the educational institutions to find the money and facilities for production, and to decide the content and style of the programme.British Columbian originated programmes account for 45% of the programme schedule.

The amount of time available as a result of a whole channel being devoted to education, and the relatively low production budgets, have led to the development of new styles of programming. For instance, as with the firefighting series, a programme may be two hours in length and consist of several segments. A university lecturer may spend 10 minutes or so talking to camera, to introduce the programme, and then show all or part of a bought-in or specially made film or video

programme. This may be folowed by a studio discussion between two or three invited experts, followed by a break (when another programme may be screened) while students do a short piece of work. The programme then resumes, with a session where students phone in their questions and have then answered live, on screen, by the panel of experts.

It also offers viewers a request service ('callers choice') for repeats of programmes they have missed or may want to see again.

7. Audiences

Programmes are aimed at children and adults throughout the province interested in educational programming as well as local colleges and other public service institutions with branches scattered across the province. In 1985, 250 communities across the province were able to take Knowledge Network programmes. There are no programmes for schools, though, because they are not linked into the cable system and do not have satellite reception equipment. There is also a shortage of suitable schools programmes, since there is no provincial schools television production facility.

Although in 1985 15809 people enrolled in courses associated with Knowledge Network programmes, in any one week about 436,000 people will watch Knowledge Network programmes. The numbers watching each year increased by 53% between 1984 and 1985. The number of enrolments is also likely to increase substantially as the British Columbian Open University Consortium starts to produce courses jointly with Knowledge Network.

Individual courses linked to Knowledge Network programmes may run from about 1,500 students (as with the firefighting series) down to about 100 students or even less. It will be seen therefore that the general viewing figures (about 300,000 a week) are important to justify the use of a whole channel on satellite and cable.

8. Patterns of communication

The main pattern is one-way television, heavily supplemented by return telephone communication from viewers dealt with live on television. Viewers can call toll-free, Knowledge Network paying for the charges.

Also important is the network of user groups set up by Knowledge Network around the province, to support programming and to provide programmes.

9. Transmission and reception

Transmission and reception equipment

Anik-C ('Anik' is the Inuit Eskimo word for 'brother') operates in the 14/12 GHz band and has a life expectancy of 10 years. Knowledge Network transferred its services from Anik-B (which offered only low-powered television transmission) to Anik-C in 1983.

The number of people and locations with ground receiving stations is not known. Most domestic reception equipment is still 2.3 metres in size (see Figure 2), although from 1983 more people are expected to purchase 1.2 metre DBS reception equipment.

Knowledge Network rents its own up-link.

Transmission time

In 1984 Knowledge Network was providing 98 hours a week of programming for transmission on

satellite, and is currently exploring the possibility of a second channel. While Anik-C is used for a range of other services (carrying for instance the Canadian Broadcasting Corporation's continental service), Knowledge Network has a full channel to itself during the day, broadcasting continuously from 9.00 am to 11.00 pm.

10. Costs

Use of satellite facilities

Knowledge Network pays C$1.055 million per annum for tsatellite transmission costs, which works out at about C$200 (£100) per hour. It is not clear whether this is a truly commercial rate, as Anik-C is Federally owned and controlled; it is most likely a marginal cost rate, since Anik-C is used for other services.

Ground equipment

Knowledge Network pays C$120,000 (£60,000) a year for up-link transmission facilities.

The 1.2 metre reception equipment is currently costing around C$5000 (£2,500), including installation, although this price is expected to reduce quickly to C$500 (£250). These costs are borne by the users, not by Knowledge Network.

Programming costs

Knowledge Network has a programme acquisition budget of around C$350,000 (£175,000) per annum, for acquiring programmes from other agencies. It has no budget for original production, which is the responsibility of the educational institutions, as is the provision of ground support.

Annual recurrent budget

C$3.9 million in 1985, of which the great proportion came from grants from the provincial government.

11. Planned duration of project

This is an on-going project

12. Evaluation findings

None available

INDIAN SATELLITE PROJECT: INSAT

Brief project description

INSAT is an Indian national satellite, operational since 1982, providing telephone, broadcast television and radio, meteorological and ground imaging services. Its main educational purpose is:

(a) to provide direct broadcast educational services to six states to up-grade rural primary school children and their teachers;

(b) to provide enrichment material for university students, their teachers and the general public; and

(c) to provide development information for the general rural audience.

Currently, it is estimated that there are about 20,000 villages able to receive these educational services through community sets, and in addition there are another 6 million privately owned sets able to receive these programmes.

2. Geography

India is the second largest country in the world in terms of population (750 million) and the seventh largest in terms of size (3.2 million square kms. - about the size of Europe, including European Russia).

Its population grows by 20 million each year. There are 15 recognized languages, with Hindi as the national language and English as an associate national language. Less than 40% of the population is literate, and the majority of people live in rural areas or small towns (there are 560,000 villages, towns and cities in India), but despite this, India is one of the major industrial and commercial nations in the world, in terms of gross national output.

3. Educational needs

While India has the third highest number of scientists and technical personnel in the world, it also has the largest number of illiterates. The literacy rate has increased from 17% in 1951 to 36% in 1981, but the number of illiterates in the same period has actually increased from 300 million to 440 million. The priority group for adult education is the 100 million illiterate adults in the economically productive 15 to 35 age-group.

There are about 18 million children in the 6 to 14 age range currently in school. Nearly 95% of an age-group now commence primary school. There are over 500,000 primary schools, of which about one-third are single-teacher, single-room schools, with about 80 million primary children. Drop-out is extremely high, only 40% of those who start school reaching fifth grade. In 1985 it was estimated that about 50 million children in the age-group 6 to 14 were not in school. Of the 1.4 million primary teachers, a large proportion are poorly qualified or unqualified. Karnik (1985) states that:

> 'it seems unlikely that a programme involving construction of the requisite number of school buildings can fructify in this century. Non-traditional methods are therefore not alternatives of choice, but necessities.'

The reason for this is that by 1996 it is estimated that the number of out-of-school primary school children will be 70 million. By 2001 there will be a total of 200 million children in the age-group 6 to 14 (out of a total population of 945 million), and 370 million adults in need of education, requiring an additional 2 million teachers. If the current educational system was to continue, it

would require an annual cost of 35,000 million rupees (£2 billion) to pay for the system, at 1971 prices.

3. Earlier satellite projects

While TV began with educational programmes for schools as early as 1959, TV coverage was extremely limited, and the coverage of rural areas was confined to the peripheries of the large cities where TV transmitters were operational. Indeed, Karnik (1985) claims that during the period 1959-1975, 'the proportion of time devoted to ETV and the importance given to it seems to have steadily declined'. This dramatically changed in 1975.

India was the first country in the world to run a fully operational satellite educational television system for a period of one year. This was the Satellite Instructional Television Experiment (SITE) which ran during 1975-76, on the American ATS-6 satellite. This broadcast over the year 1320 hours of educational material, four hours a day, in four different languages, to 2,330 villages in otherwise remote areas of six states (Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Orissa, and Rajasthan). The total cost to the Indian government of the SITE project was 150 million rupees (£10 million), although the satellite (which cost US$200 million) was provided on free loan by the US government for a period of one year. The Americans moved it back to its original geo-stationary position in 1976.

A second Indian satellite project was conducted between 1977 and 1979, using the Franco-German Symphonie satellite, this time for teleconferencing.

A third educational satellite experiment was carried out in 1981. This was the Ariane Passenger Payload Experiment (APPLE) which lasted for 27 months on an experimental satellite. During this time a full course was delivered by television for satellite communications engineers in five different centres, each over 1,000 kms. away from each other. The course consisted of seven hours of television lectures, lecture notes and two-way voice links. There were altogether 116 students who followed the course, and an evaluation (Agrawal, 1983) indicated that the experiment met its instructional objectives, but the costs involved would probably rule out such a system except for very special applications.

This report draws on experience and lessons from these two earlier projects, as well as from the INSAT experience.

4. Target groups and main educational objectives

The educational satellite transmissions aim to improve the spread and quality of education for:

(a) rural primary school children, aged between 5-8, and 9-11, both in school and out of school, and their teachers; the main purpose of programmes aimed at rural primary schools is enrichment, with the intent of widening horizons, developing scientific thinking, fostering national integration, and advising on balanced diets and hygiene; the main purpose of programmes aimed at their teachers is to improve the competency of rural primary school teachers by enriching their knowledge content; improving their pedagogy; and demonstrating how to use television for teaching purposes. Note that the aim is <u>not</u> to use television for direct teaching, in place of, or to by-pass, classroom teachers

(b) University level students, teachers, and the educated general public; these are programmes of general cultural, social or scientific interest, meant to enrich study at a higher education level, although as the Indira Gandhi National Open University develops, it is expected that programmes related to distance education courses will also be developed.

(c) the general rural audience; the main purpose of these programmes are as follows:

i. to support agricultural extension work, particularly for the weaker and underprivileged agricultural sector

ii. to improve public health and hygiene, and family welfare

iii. to develop scientific thinking amongst rural adults

iv. to promote social justice

v. to stimulate interest in news and current affairs

5. Programming

Schools and teachers

There are two different programmes of 20 minutes every day, one aimed at rural children aged 5-8, and one aimed at a slightly older age-group (9-11) broadcast over a period of nearly four hours in the morning Monday to Friday, but transmitted five times in five different languages (note that the same programme is not transmitted with five simultaneous language versions). There is a five minute break between each lesson, to allow classes to change over. (The set is usually located in a central building in the village, often the school).

There is also a weekly programme aimed at teachers, broadcast on Saturday mornings.

University

There is one hour of programming between 12.45 to 13.45, repeated between 16.00 to 17.00 in the afternoon (most programmes are about 20 minutes in length). All programmes are in English; some programmes are Indian made, others are imported from other countries (e.g. from the British open university). Special production facilities are being set up in 11 different universities to make programmes for this slot. At present, the programmes aim at enrichment, and are not course-specific. No printed support material is provided, although it is intended later to make such programmes course and subject specific, especially for the distance education courses of the Indira Gandhi National Open University, which began teaching its first students in 1987.

General rural

There is a 40 minute transmission each evening for general rural programmes, in addition to 40 minutes of national news and current affairs, in agriculture, health, family planning and nutrition. There are general news and entertainment programmes in the evenings which are nationally networked in Hindi, and area-specific programmes in the local language of the target area, of which a large number are educational.

6. Distribution system

INSAT-1A was launched by NASA in 1982, but due to moon interference, there was a total loss of satellite propellant fuel, and the satellite was lost. Services were temporarily carried on an Intelsat satellite then a Russian satellite (STATIONAR) until INSAT-1B was launched in 1983 by the Space Shuttle 'Challenger'. There is one main up-link in New Delhi, which means that tapes from various cities have to be sent to Delhi for transmission.

INSAT-1B has 12 C-band channels and two high-powered S-band channels, one of which is used

STATES COVERED BY INSAT

to network the national television service, Doordarshan, and the other to carry the educational direct broadcast service to otherwise remote villages in six states (Andhra Pradesh, Bihar, Gujarat, Maharashtra, Orissa, and Uttar Pradesh).

INSAT-1C is booked on to the Ariane launch manifest for the beginning of 1988. This will act as an active, on-orbit spare. The last satellite in the INSAT-1 series, INSAT-1D, is due for launch early in 1989. Each satellite has an anticipated life of seven years. The first of the second generation INSAT satellites, the INSAT-2 series, which will also be multi-purpose but have significantly higher service capacities, is due to be launched in 1990.

The educational programmes are distributed in two ways. Currently, 3.5 metre, locally constructed chicken-mesh aerials have been installed in 2,000 villages for direct broadcast reception on specially designed community television sets. These are supplied by Central government. In addition, local television stations receive the programmes by direct broadcast, then re-broadcast the signals terrestrially for reception on 4,500 VHF community television sets (also locally manufactured). Increasingly, responsibility for the provision and maintenance of these community sets is being passed over to the local State government. In two states in addition to the main six states (i.e. Rajasthan and Madhya Pradesh), the state governments also provide sets and relay the satellite programmes. It is now estimated that there is a total of about 20,00 community TV sets throughout India. The schools programmes are re-transmitted on VHF in all Hindi-speaking states as well as being able to be received on local DBS receivers in the six main states. The university programmes are retransmitted in all States for VHF reception, via the satellite networking arrangement.

It was originally planned to expand the number of community village television receivers to 8,000 DBS and 6,600 VHF sets by 1987 through central government financing. Significantly, though the Department of Space commented in the original plan:

> 'The constraining factor in large-scale growth of the INSAT-1 utilisation is essentially the investment involved in provision of community TV receivers (direct satellite reception or VHF type) and rebroadcast transmitters.'

It seems then that since the original proposals, there has been a change of policy, with Central government through the Ministry of Information and Broadcasting putting more emphasis on the construction of local VHF transmitters to relay satellite signals, and local State governments being given the responsibility for the provision of both VHF community sets in areas within the local transmitters, and DRS community sets for areas not covered. The reasoning behind this change of policy is that for the same money, many more people can be covered by television transmission.

By 1987, 210 local transmitters have been constructed, and the use of the other S-band channel for networking now means that 70% of the population can be covered by VHS transmission, and 100% by satellite transmission - providing of course that they have suitable reception equipment.

Currently, there are approximately 6.8 million sets in India, of which 0.1% are community sets. 60% of all sets are located in four cities (Bombay, Calcutta, Madras, and Delhi.) Less than 5% of all sets are located in rural areas. A major consequence of the decision to put more central government money into local transmission and less into direct reception community sets is that the main people now able to receive television transmission live in urban areas around the transmitters, and there is already evidence that this is leading to increased television ownership among the rich middle-classes. Thus social scientists such as Agrawal (1986) fear that demand from the richest 5% of the population that own the vast majority of sets will lead to pressures for more entertainment and less educational programming.

7. Ownership, regulation and management

INSAT is a joint project, involving the Department of Space, the Ministry of Communications, the Ministry of Tourism and Civil Aviation, and the Ministry of Information and Broadcasting. The project is managed by a joint committee from the various departments. The Ministry of Information and Broadcasting is responsible for general television services (known as Doordarshan).

The management though of the education component is the responsibility of the Ministry of Human Resource Development (i.e. the Department of Education).

Schools and teachers programming

The programmes for schools and teachers are the responsibility of the Ministry of Human Resource Development (i.e. the Ministry of Education), which also receives some technical assistance from UNESCO/UNDP for consultants, fellowships, and some technical equipment.

The Central Institute for Educational Technology (CIET) within the National Council of Educational Research and Training (NCERT) is responsible for co-ordinating the INSAT schools television service between the centre and the states. Its functions are as follows:

- planning of the schools television curriculum
- script-writing
- production of approximately 100-120 programmes a year (this function eventually to be taken over by state production centres)
- dubbing of regional language variations for its own programme production
- preparation and distribution of teachers' notes to go with programmes
- training of state programme production personnel
- training of state utilisation agents
- research, evaluation, and monitoring of utilisation
- preparation and distribution to teachers of integrated (i.e. central and state production) television transmission schedule

Each of the six states also has a State Institute of Educational Technology (SIET). The SIETs have responsibility for translating, printing and distributing to teachers the notes to accompany locally produced programmes, as well as the local (state) TV schedule for the educational programmes. They will also eventually have responsibility for production (see below).

University

The Indian University Grants Commission has organised the transmission of programmes aimed primarily at university-level students. The main body responsible for the operation of the system is the UGC, with operational activities located in the Mass Communications Research Centre, in Delhi, though the programmes to be transmitted are chosen by representatives of universities and national institutes. Reception equipment and television sets are to be placed in 5,000 colleges for the reception of these programmes, although by 1987 only 1,800 had been installed. It is left to individual colleges to decide how to use the transmitted material.

General rural audience

Programmes for this area are determined by an inter-ministerial committee, consisting of representatives from the following ministries: Food and Agriculture; Rural Development; Health and Family Welfare; and any other ministry with an interest in rural development. The programmes are planned to link in with the rural extension services each of these ministries provide in the field.

8. Production

At the moment, there are about 250 programmes a year being produced specially for the INSAT educational projects. Up to 1987, about two-fifths of these programmes were produced by CIET in Delhi, and the rest of the production was done by Doordarshan.

Eventually, each of the states will have its own production centre within its SIET, but up to 1987 it was usually the local Doordarshan production centre which made the local programmes for the satellite project. However as SIET production centres are established in each of the six states, it is anticipated that these will eventually be responsible for the bulk of educational production for schools.

9. Patterns of communication

The satellite, as far as education is concerned, is used for a simple 'one-to-multipoint' television distribution system. There is no form of two-way communication for educational purposes.

10. Audiences

There are no overall measures of audience figures. In each village, there is usually somewhere around 100 - 200 children viewing each school broadcast, and between 50 to 200 villagers watching the general rural programming in the evening. This would give figures of around 2-4 million on average for each programme (20,000 x 100) watching educational programmes on community sets.

11. Utilisation

For each school two TV custodians are appointed, each teacher receiving two days training on the operation of the set and its use with TV classes. The senior custodian receives 50 rupees a month, and the assistant receives 25 rupees a month. They are responsible for both the children's viewing in the morning and the adults' in the evening.

Some reports suggest that at any one time only between 25% and 65% of community sets are actually available for use. This may be due to malfunction of the set or reception equipment, unavailability of the set because the custodian has not made it available, or failure of the power supply. Effective set maintenance varies considerably, depending on the resources and skilled engineers available in a particular area or state.

12. Costs

Satellite facilities

The total cost of the space segment (three satellites, their launch, launch insurance, and Master Control Facility) was 226 crores (2,260 million rupees or £125 million). This of course covers all the uses of the satellite, and not just the educational use. It must be remembered that one satellite was lost.

Ground equipment

The INSAT programme was accompanied by an expansion of the terrestrial TV transmission facilities. This entailed building 210 TV transmitters, each capable of receiving and relaying the S-band satellite signals. Costs for this component were approximately 68 crores (68 million rupees or £37 million), but it would not be appropriate to assign most of this cost against educational use, since these stations were built mainly for general television services.

Programming costs

In addition, funds have been put aside for the cost of production facilities for educational programming. The Indian Central Government committed 120 million rupees (£6.6 million) between 1980-85 for production-related activities, as follows:

CIET	74,600,000 rupees	(£4 million)
SIETs	45,400,000 rupees	(£2.6 million)

In addition to this Indian Government funding, the United Nations Development Programme (UNDP) has provided over the same period a total of US$2.267 million (29 million rupees or £1.6 million), primarily to support the development of CIET, through training, additional equipment and experts.

The programme budget for a 10-15 minute schools programme at the CIET production facility is around 5,000 rupees. With 250 programmes a year being produced, this gives an annual production cost of around 1.25 million rupees (£70,000) for the schools sector. This is a marginal cost and does not include overheads or an allowance for capital costs, interest, depreciation, etc. The University sector appears to have had a total budget of around 20 million rupees (£1 million) for programme purchase.

Teacher training and utilisation

Costs for teacher training have not yet been identified. With 6,000 community sets, and two custodians per set, the cost of custodians alone will be 5,400,000 rupees a year.

Annual recurrent budget

With figures currently available, it is impossible to estimate the annual recurrent budget.

13. Planned duration of project

This is an on-going project.

14. Evaluation findings

A considerable amount of evaluation was conducted on the original SITE project, much of which is well documented and publicly available. While there is less available at the moment on INSAT (it takes several years before a wide range of evaluation findings become available) there are already a number of clear lessons emerging.

First of all, the precedent set by SITE of extensive formative and summative evaluation is being continued with INSAT. CIET is responsible for the following evaluation activities:

- audience profile studies
- needs assessment research
- in-field formative evaluation
- collection of feedback from teachers
- utilisation monitoring
- impact studies

Some of the results (from both SITE and INSAT studies) indicate the following:

(a) satellite TV can help to break down social, sex and caste barriers within villages, especially through communal viewing

(b) satellite TV has been particularly helpful in improving villagers knowledge of hygiene and family welfare, and news and current affairs

(c) women and children in particular appear to have benefited most from the satellite TV programmes

(d) problems arise though when the facilities which the programmes suggest be used are not available (as often happens), e.g. lack of available local officials, lack of fertilisers locally, lack of loan facilities

(e) problems also arise when programmes do not relate to specific local conditions (e.g. crops, language/dialect, local difficulties)

(f) there are major hardware problems: in some areas less than 25% of the sets are claimed to be working (see Sinha, 1984); power supply is often erratic; the TV custodian is not available to operate the set; there is a lack of continuous training for teachers, which results in poor motivation to use the programmes or to integrate it with the rest of the teaching

(g) there are also major programming problems: many students find the higher education programmes irrelevant, and in some areas find it very difficult to follow the English commentary, particulary in foreign programmes; teachers and learners often want more didactic and more relevant programmes; producers and designers though believe more in the enrichment model

(h) access to reception facilities tends to be a neglected aspect, yet the provision of community sets is essential for education and training purposes for low-income people in developing countries; maintenace facilities in particular are crucial, but can ensure high reliability if properly organised on a local basis.

(i) special arrangements need to be made for responsibility of community sets, which both ensure continual and reliable availability to villagers, whilst avoiding censuring of messages unpopular with powerful village people such as rich landowners; organisation of viewing is important, and requires training of TV custodians.

(j) support material is of vital importance, in the form of printed booklets, wall posters and suggestions for activities and questions for discussion

(k) feedback on all parts of the system is essential; communications researchers and content experts have an important role to play, so a team approach to production is important.

Some of the main lessons learned already are:

(a) the introduction of an educational satellite service requires new infrastructures for programme planning, production, supply, and maintenance of equipment

(b) too much attention is given to hardware issues, and not enough to"courseware" and human issues; courseware planning and production needs more time than hardware planning, and production and utilisation are usually underfunded compared with hardware requirements;

(c) teacher training in the use of the technology is essential, and is required on a continuous basis

(d) there are major problems with language in programmes, even when programmes are available in four different languages

(e) educational satellite projects require firm commitment and bold decisions from government, and consistent support

(f) a systems approach is essential to integrate satellite education with the rest of the system; integration will not occur if a satellite system is merely patched on to an existing system; equal attention needs to be paid to all parts of the system, including programming and utilisation, and not just the satellite hardware

(g) while there are high capital costs, the recurrent costs in running a service are also substantial

(h) for areas as large and diverse as India, there is a need for national, regional and local programming; this means decentralised production to match the needs of local areas, and a flexible network arrangement that provides national, regional and local coverage. The pressure for local programming requires a hybrid system of direct satellite and ground broadcast transmissions, with the satellite playing a dual role of networking transmitters and direct broadcasting. This requires at least two separate channels or transponders.

A.W.Bates
25/10/87

UNIVERSITY OF THE SOUTH PACIFIC PROJECT: USPNET

1. Brief Project Description

The University of the South Pacific covers 11 English-speaking countries in the South Pacific. Funding is provided by the 11 member countries with additional support from international aid donors. In 1974 it established its own experimental satellite network and devised a series of projects to test the effectiveness of satellite activities, using the NASA satellite ATS-1. ATS-1 was used until 1985, when it was decommissioned by NASA.The network provided voice and data communication via ATS-1 between 11 centres in nine countries, supporting both credit and non-credit distance education courses for adults.

Since 1986, USPNET has been operating on INTELSAT-V, linking initially the Cook Islands, Fiji, Kiribati, Solomon Islands, Tonga and Vanuatu University Extension Centres. Nauru was connected in 1987 and Western Samoa will be connected in 1988 when its earthstation is completed. Tuvalu, Niue and Tokelau are connected through a VHF radio link .

2. Geography

The University of the South Pacific is a regional university serving the following countries:

Cook Islands
Fiji
Kiribati
Nauru
Niue
Solomon Islands
Tokelau
Tonga
Tuvalu
Vanuatu
Western Samoa

The combined population of the eleven countries is around 1.5 million, with approximately half living in Fiji, where the USP has its main campus situated in the capital, Suva. The 11 member countries of USP are scattered over 11 million sq. kms. of ocean - an area greater than Australia, although the total land mass is equivalent to that of Tasmania (see Figure 1). The USP region covers four time zones, and straddles the date-line. Consequently, a tutorial finishing in Suva at 8.00 pm finishes at 10.00 pm in Rarotonga, and Monday in Suva is Sunday in 3 of the countries!

Although the 11 countries are all poor in monetary terms, enrolment for each subject costs a student Fijian$50 (£25 sterling). (This is more than 100 times the minimum hourly wage.) In addition, the student must buy textbooks, audio-tapes and pay $15 for the Extension Centre fee.

3. Earlier satellite projects

From 1974 until 1985, USP used the NASA satellite, ATS-1. It was originally positioned 37,000 km above the equator over Christmas Island. In 1982 ATS-1 shifted position above Nauru where it remained in geostationary orbit until it was decommissioned by NASA in 1985. Although the move to the new position (165° E) took more than twelve months to complete, service was maintained by USPNET antennas continually tracking the satellite as it moved.

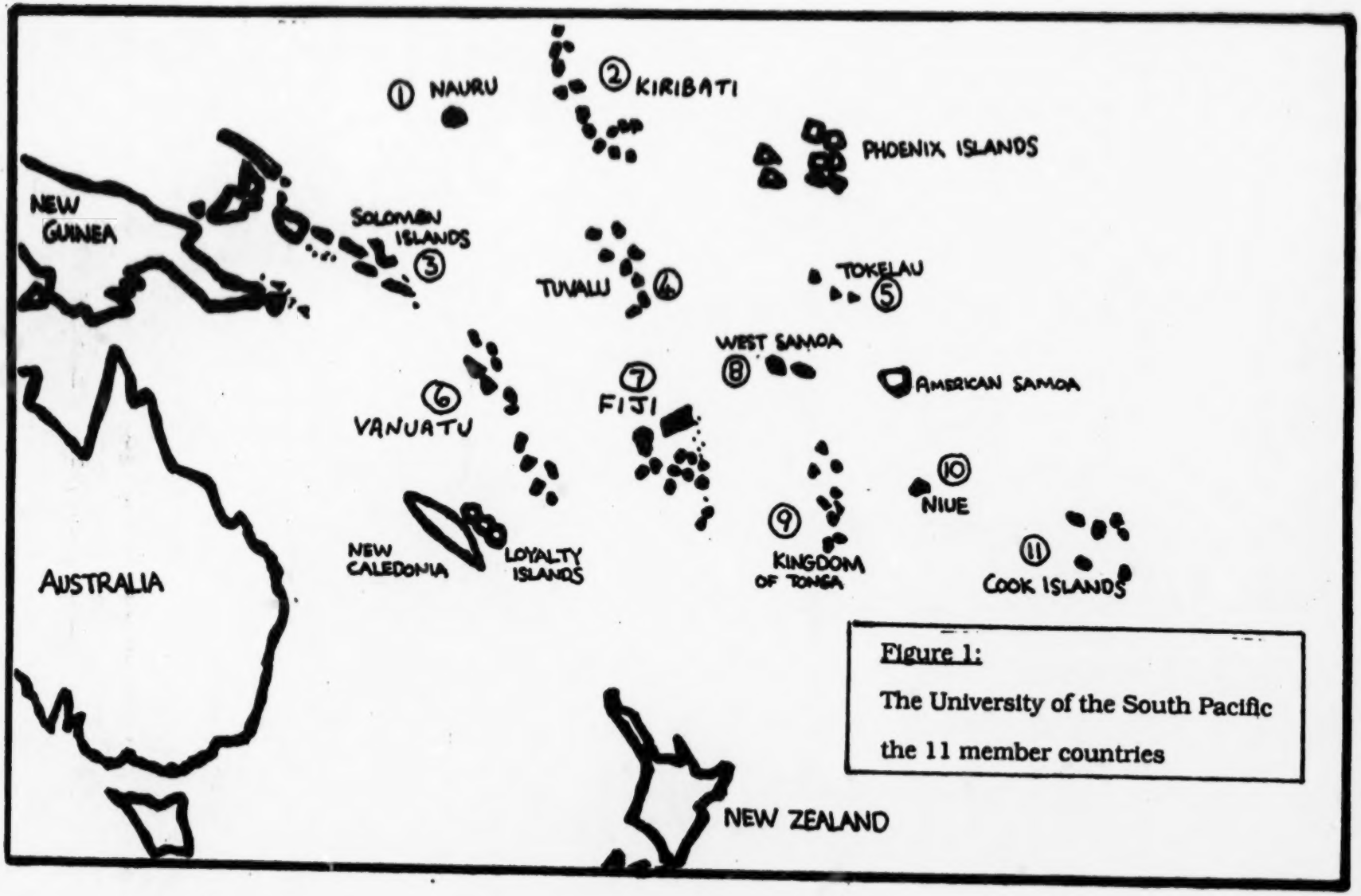


Figure 1:

The University of the South Pacific

the 11 member countries

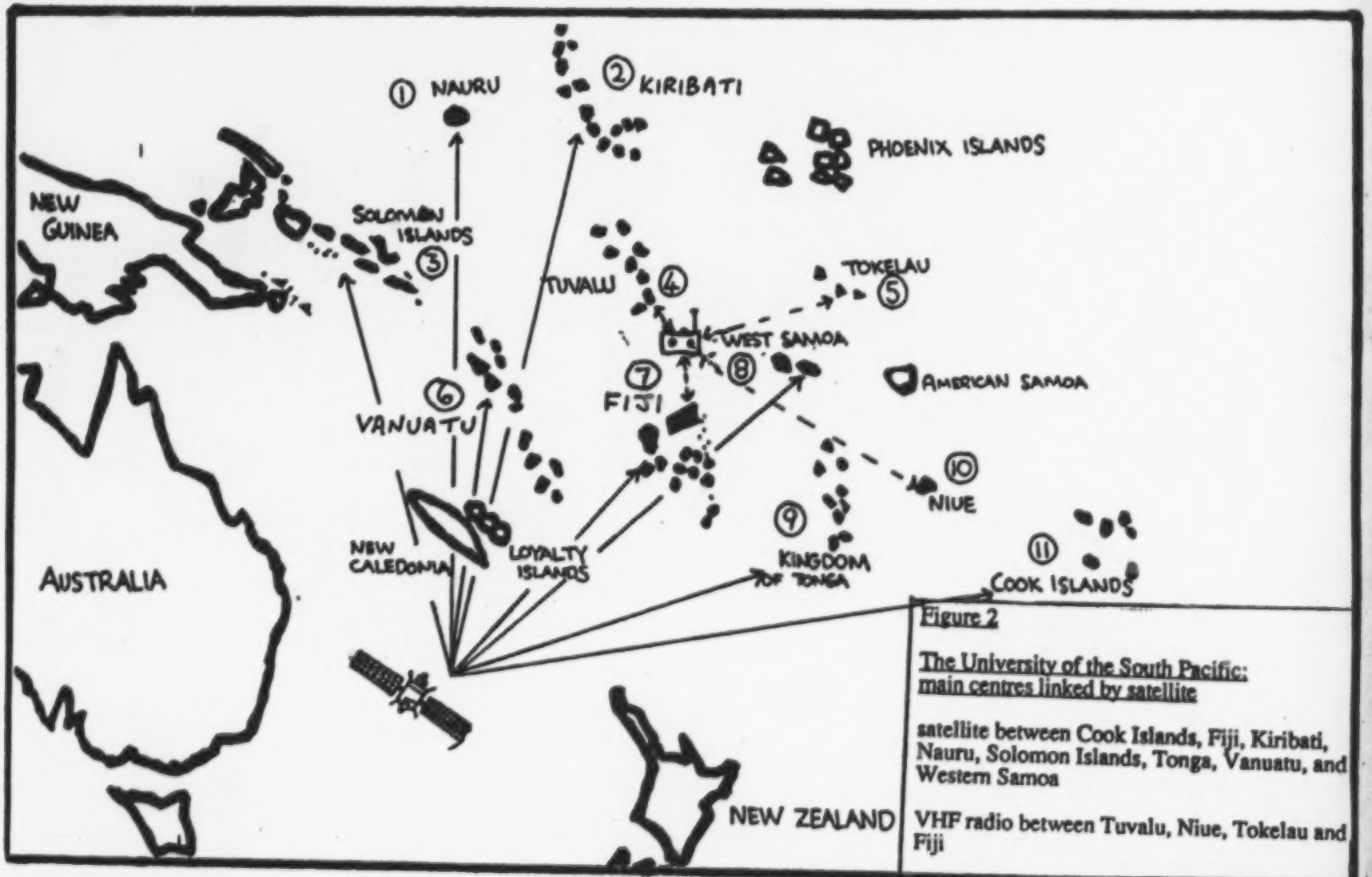


Figure 2

The University of the South Pacific: main centres linked by satellite

satellite between Cook Islands, Fiji, Kiribati, Nauru, Solomon Islands, Tonga, Vanuatu, and Western Samoa

VHF radio between Tuvalu, Niue, Tokelau and Fiji

USP was allocated 23 hours per week broadcast time by NASA, which it divided between credit courses, tutoring sessions, advice on education courses, conferences and administration sessions.

Terminals were set up in 9 of the 11 countries. The USP network terminals also participated in activities through the PEACESAT network co-ordinated by the University of Hawaii. PEACESAT (Pan Pacific Educational and Communication Experiments by Satellite) offered a wide range of educational, medical and social seminars and conferences throughout the Pacific.

USP ceased using ATS-1 in August 1985. The satellite had long outlived its usefulness and NASA decided to decommission it, as reception was deteriorating.

4. Target groups and main educational objectives

The target group are registered USP students in the all the previously named countries in the USP region (except Fiji, where the main campus is located).

The 11 member countries cannot afford to send many of their students away to the main campus in Fiji. Since its inception then distance and continuing education have been two of the most important areas of USP's work. The Division of Extension Services has two parts: *Distance Education* is responsible for all credit courses while *Continuing Education* caters for all non-credit programmes. Only 28% (1872) of the 6664 USP students in 1985 were internal, 42% (2782) being Distance Education and 30% (2010) Continuing Education students.

USP consists of four schools: Humanities; Pure and Applied Sciences; Social and Economic Development; and the School of Agriculture. As well as the main campus in Fiji, there are nine Extension Centres in the 11 member countries, plus the following four specialist institutes:

- the Alafua Agricultural Campus in Western Samoa
- the Institute of Rural Development in the Kingdom of Tonga
- the Pacific language and the Pacific law units in Vanuatu
- the Atoli Research and Development Unit in Kiribati.

The Extension Centres are the main communication links between the centre and each of the 11 countries. Student study materials and assignments are carried by the weekly airmail bag system to and fro between the Extension Centres and the main campus in Fiji. In addition, students have to get their assignments to the local centre, so assignment feedback can be long in coming. The Extension Centres also advise and counsel potential new students, advertise USP, act as focal points for administration, provide tutorials and give access to media such as computers and the satellite.

5. Programming

USPNET had an average of 4 hours programming per day, Monday to Saturday, and a total of 23 hours per week. The general programme pattern was as follows:

Morning: administration
course management
logistics
co-ordination of outreach programmes

Afternoon: conferences and seminars

inservice training/upgrading
consultation with resource people/other agencies

Evening: tutorials between students and USP staff

Course management and administrative support

Approximately one hour per week was devoted to voice communication between the central Extension Studies team and staff in the 10 regional centres with regard to enrolments and the distribution and supply of course materials. In addition, the system was used for various pre-planning and follow-up activities for regional face-to-face workshops and conferences, by both USP and non-USP agencies (e.g.WHO, UNFPA, etc.). The system was also used for administrative communication between different campuses and centres.

Inter-Networking

USPNET was used to link with other institutions (mainly through its connection with PEACESAT) in Honolulu, New Zealand, Papua New Guinea, American Samoa, New Caledonia, Guam, Canada (British Columbia), U.S.A. mainland (California), and Australia.

Student tutorials

USP provided satellite tutorials for up to 11 hours per week with a range of preliminary foundation and degree level courses offered by extension. A course tutor was able to discuss relevant course units, student difficulties, assignment problems, etc. with the students and local tutors.

The following courses were offered at degree level:

Accounting, Sociology
Macroeconomics, Admininstration.
Land Tenure, Politics and Government.
Cultural Geography, Human Development.
Introductory English and Mathematics.

Tutorials were scheduled on a regular weekly or fortnightly basis during the semester. A tutorial programme was usually decided upon in advance and distributed to students and local tutors at the beginning of each semester.

In the Continuing Education area, there was an emphasis on encouraging community development groups to exchange and share information, ideas and expertise. Much of the University's involvement in PEACESAT came under this heading.

6. Distribution System

ATS-1

The basic distribution system was two-way radio via the satellite between the centre and the nine local Extension Centre sites. The VHF transponder was an active frequency - translator limiting (class C) repeater, receiving at a frequency of 149.22 mhz and re-transmitting the received signal at 135.6 mhz reception. Each centre had its own radio transceiver. Originally, these were of the kind used by radio taxi services, and cost around US$5,000 each, but later professional standard radio transceivers were purchased.

In addition, computerised data and information was sent using teletype equipment for use on Apple II microcomputers in all 9 centres, and facsimile equipment was available in three of the campus sites.

Much of this was funded from a grant of US$705,000 received from USAID to improve facilities for all terminals in the region.

INTELSAT

Cook Islands, Fiji, Kiribati, Solomon Islands, Tonga and Vanuatu University Extension Centres gained access to Intelsat V in September 1986 through a special arrangement with the international carriers and Intelsat.

Nauru, which did not take part in the ATS-1 experiments, has become connected via INTELSAT following the establishment of a USP University Extension Centre there in 1986. It has though limited access for 2 hours a day from 1st September, 1987, due to equipment problems at their earthstation. This will be rectified in 18 months when Nauru expects to purchase a small earthstation. The service will be free.

A temporary HF linking arrangement has been arranged with Western Samoa while its earthstation equipment is being installed. This will allow the Western Samoa Extension Centre to access INTELSAT probably by 1988.

Niue has no earthstation so access is provided through VHF radio. Tuvalu similarly has no earth station. It will be at least three years before it can purchase a small earthstation. In the meantime an HF radio link with Tuvalu and Fiji will be established in October, 1987. A line from the P & T to the USP Extension Centre on Tivalu will also be installed, for which the rental will be about $10 per month.

Thus it can be seen that USPNET has two systems linked to it until all countries have purchased earthstations connected to the Intelsat link.

Until low cost equipment for television transmission is developed it is not anticipated that visuals will be available because of the cost. The University media Unit is hopeful that this will eventually be available. It is including plans for such an event in the design of new facilities planned at the Extension Services Headquarters in 1989.

Data transmission facilities and software for IBM computers are being tested now before linking up the Extension Centres already on INTELSAT. The second stage would involve linking in the IBM PC network to the VAX system which is located on the Laucala Campus in Fiji for all data processing. An Australian University is providing the expertise for the communications software. The data transmission service is expected to begin in October, 1987.

USPNET operates on one channel 767 and channel frequency is 6336.4925 megahertz. USPNET does not have its own up-link, but is connected by telephone line to the local P&T up-links.

7. Production

The majority of programming is either teleconference meetings by radio and telephone or 'live' tutorials.

However, there are two audio/video production studios, in Fiji and Western Samoa respectively. It is hoped that video replay facilities will be added to the system eventually. In the meantime video cassettes are distributed by mail to the Extension Centres as they become available.

Slow-scan television experiments, enabling a video picture to be sent via the audio band (70 seconds per frame) were conducted during the ATS-1 project. As with full video, it is planned to use slow-scan television in the long term.

Programming for INTELSAT allows USPNET to have access to a 24 hour service. The daytime hours are utilised fully for administration, teleconferencing and tutorials.

The evening hours will be used for electronic information exchange once the equipment and software have been evaluated and installed. This will be invaluable for overnight transmission of data between Centres in the region and the Alafua Campus in Western Samoa. (The service is not available to other than USP users, due to regulatory constraints imposed by carriers.) Eventually it is hoped to have the information exchange network operating automatically via the VAX computer installed in the University's Computer Centre.

8. Ownership, regulation and management

ATS-1

ATS-1 was owned by NASA (a USA government agency), the use of which was provided free of charge to USP for up to 23 hours a week. The programme schedule within the 23 hours allocated to USP was determined by the Division of Extension Services at USP, which was also responsible for all ground services, including technical facilities.

The Distance Education Unit at the main campus in Suva, Fiji, handles enrolments, the receipt and return of assignments and the forwarding of examination results. There is a media unit on site, located in the same complex, and including graphics, photography, video production, audio and satellite transmission, and text processing.

INTELSAT

While the Extension Services section of USP icontinues to be responsible for the management and administration of the educational programme via satellite, management arrangements for the use of the INTELSAT satellite are proving to be more complex. INTELSAT is a private company owned by a consortium of national PTTs and international communications carriers. In 1984 the Prime Ministers of the relevant countries instructed the South Pacific Bureau for Economic Co-operation (SPEC) to find ways of providing an alternative satellite system to replace ATS-1. The Telecommunications Development Programme of SPEC agreed in 1986 that USPNET could gain access to an alternative satellite by arrangement with all the national carriers (PTTs) in the eleven countries of the region. It is through this mechanism that agreement was reached by the countries in the USP region to allow USPNET to gain access to INTELSAT-V in 1986. In effect a regional approach is the key feature of the agreement.

Fiji P&T is the local telecommunications PTT. USP works directly with FINTEL (Fiji Telecommunications) which is an international carrier and a signatory to INTELSAT. USP's contract is with FINTEL. FINTEL represents the PTTs in the eleven countries which make up the USP region. FINTEL is also responsible for any technical problems with transmission. The agreement prevents USP from linking to any other countries or institutions at the moment.

USP encountered considerable resistance from within Fiji P&T to the use of telecommunications for anything other than telephone and telex communications, although FINTEL was much more sympathetic to the use of satellites for education and development in the region. There is still strong opposition from certain staff within the Fiji P&T to USP accessing other satellite systems, such as AUSSAT. The establishment of the South Pacific Telecommunications Development Programme greatly facilitated planning of new developments in communications and changes in policy within individual PTTs and also helped to establish more moderate tariffs, through bulk purchase and standardisation of equipment through the region. Being established by Heads of Governments, SPTDP provided a necessary counter-balancing force to the otherwise monopolistic PTTs. The development of satellite communications in the region was also greatly facilitated by an experienced and knowledgeable Co-ordinator for SPTDP.

9. Patterns of communication

ATS-1

The basic distribution system was two-way radio via the satellite between the centre and the nine local Extension Centre sites, supporting print materials. However, communication was 'simplex' rather than 'duplex', i.e. only one speaker could speak at one time, which made interruption difficult. To get two-way interaction, users had to remember to switch off their microphones when not talking, and to switch them on again when they wanted to talk.

INTELSAT

The basic distribution system via two-way (half-duplex) radio via satellite, as established on ATS-1, continues on INTELSAT-V. 'Press to talk' equipment is being considered, but cost remains a problem. The Centres are connected to local earthstations by telephone lines.

Local carriers impose regulatory constraints which restrict USP to using the satellite system only for the distance teaching programme administered by Extension Services. USP is disallowed from linking with international institutions outside the USP region, despite a long, sometimes bitter battle to get the carriers to accept that the use of INTELSAT to link USP with other distance education institutions in Australia, New Zealand, Papua New Guinea, Canada, etc. for educational purposes would contribute to the general development pf the region. Nevertheless, it is hoped eventually to persuade P&T to allow USP to link with other international institutions including data-banks, libraries, etc.

10. Audiences and utilisation

In 1986 there were just over 3,000 part-time distance education and 2,000 continuing education students in the 11 countries who were the targets for the programmes, but not all could get to the local centres, and a substantial proportion would be in Fiji, which did not receive the satellite tutorials.

In a period of just over a year, from mid-1983 to end-1984, 33 members of staff conducted 236 satellite tutorials and there were 1,668 student attendances, an average of seven students per tutorial. Student attendance varied from between 25% to 60% of enrolled students in each country receiving the satellite tutorials.

From 29 September to 15 November, 1986, 373 students attended tutorials offered from campus involving 26 tutors. In Semester 1, 1987, 546 students attended 25 tutorials. The increase in

numbers was the result of the closure of the University campus for 5 weeks. Students from the region returned home but many participated in tutorials offered from campus to internal students in their home countries.

11 Costs

Satellite facilities

The space segment on ATS-1 was provided free by NASA; space segment charges by INTELSAT and land-line charges by local carriers total US$17,000 annually for the six terminals now linked to INTELSAT. Additional terminals will change this cost. This tariff was negotiated by USP with the carriers through the South Pacific Telecommunications Development Programme. This programme co-ordinates telecommunications on a regional basis. Members consist of all P&Ts from countries and they meet regularly to evaluate development in telecommunications in the region.

Ground equipment

For ATS-1, up-graded equipment was provided through a USAID grant of US$705,000; for INTELSAT, the same equipment is used. University equipment maintenance is funded from USP recurrent funds. HF equipment for four countries has been provided by USAID.

Programming costs

These are found as part of the normal, recurrent budget of USP, the main 'cost' being the time of the tutor, and the studio technical staff. There are therefore minimal production costs associated with use of the satellite.

Ground support

Again, the cost of local tutors comes from the USP recurrent budget, as they are needed whether or not satellites are used.

12. Planned duration of project.

USPNET utilised Project SHARE arrangements from September 1986 to September 1987. It now pays for the service from its recurrent budget.

13. Evaluation findings

During the ATS-1 project, student attendance was found to be erratic. A number of factors accounted for this. The problems of scheduling at convenient times for all students over four time-zones and different days was one factor. Towards the end of the ATS-1 project, the satellite tended to gyrate and drift, resulting in inconsistent reception quality, sometimes quite quickly changing from good to bad. (This is a result of using a satellite beyond its originally projected life.) Cultural factors also affected attendance. People were often expected to be at home for the evening meal and/or to prepare meals; young people, especially females, were often not encouraged to be out after dark.

Tutors also commented on the need for careful pre-planning of satellite tutorials, and the need for

careful enunciation. Tutors generally found satellite tutorials more difficult than face-to-face tutorials. As with face-to-face tutorials, tutor talk dominated (around 76% of the time), but it was found that the ratio of tutor/student talk could be improved with training. Nevertheless, the 'simplex' nature of the transmission, the lack of visual contact, and the physical separation of tutor and students, did lead tutors to comment on the difficulty of encouraging student interaction. The relatively low numbers of students present at each tutorial caused some tutors to question the return for the effort put into the tutorials.

Nevertheless, those students who did attend satellite tutorials valued them as aids to their learning.

No research has yet been done during the INTELSAT project, and hence the earlier findings do not necessarily apply to the current project.

14. Acknowledgements and references

I am grateful to Marjorie Crocombe, Director of Extension Services, USP, for much of the information contained in this report. The following papers also provided valuable information included in this report:

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UNIVERSITY OF THE WEST INDIES: UWIDITE

1. Brief Project Description

The University of the West Indies was founded in 1946 and incorporated by Royal Charter in 1962. It is a regional institution supported by 14 West Indian countries.

Project Satellite was an initial demonstration project in 1978, using satellites to provide full motion television from Jamaica with return audio. The links were between two campuses (Jamaica and Trinidad) and the University Centre in St. Lucia.

As a result of the experience of Project Satellite, the University of the West Indies Distance Teaching Experiment (UWIDITE) was established in 1982. UWIDITE uses an INTELSAT satellite primarily for audio teleconferencing between Trinidad, Jamaica, Dominica, Barbados, Antigua and St. Lucia.

2. Geography

The fourteen countries which are covered by the University of the West Indies are: Antigua and Barbuda, the Bahamas, Barbados, Belize, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St. Christopher and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and the (British) Virgin Islands (see Figure 1).

The largest of these countries in both size and population is Jamaica, with roughly half the total population (2 million out of 4 million). Trinidad and Tobago has about one million population, and Barbados about 250,000. The Bahamas have just over 200,000. The distance from Belize to Trinidad is about 2,000 miles.

There are three main campuses: one (the oldest) at Mona, Kingston, Jamaica; another at St. Augustine, Trinidad; and the third at Cave Hill, Barbados. There were 10,837 students in 1986/87, spread across the three campuses. Of the recurrent costs, 50% comes from the government of Jamaica, 34% from the government of Trinidad and Tobago, 12% from the government of Barbados, and the remaining 4% from the smaller islands.

3. Earlier satellite projects

Project Satellite was mounted over a period of three months in 1978. Using NASA's ATS-6 and ATS-3, it linked the Mona and Cave Hill campuses, and for a shorter period of two weeks the University centre in St. Lucia. Demonstrations, teleconferences, lectures and outreach programmes in medicine, agriculture, engineering, energy and education were transmitted through the satellites.The University of Miami in the USA also shared the frequency and helped as needed with relays and advice.

The satellite link was used for two extra-regional programmes during this project: an energy seminar with the Solar Energy Research Institute in Colorado, USA; and a teleconference between participants in Mona and Cave Hill, and others across the Pacific basin from California to New Zealand. Experience from this project led to the establishment of a feasibility study, funded by a grant of US$330,000 from USAID. The feasibility study (CARCOST - Caribbean Regional Communications Services Study) included demonstrations of slow-scan television, facsimile transmission of documents and a two-month long experiment in Jamaica on distance teaching by

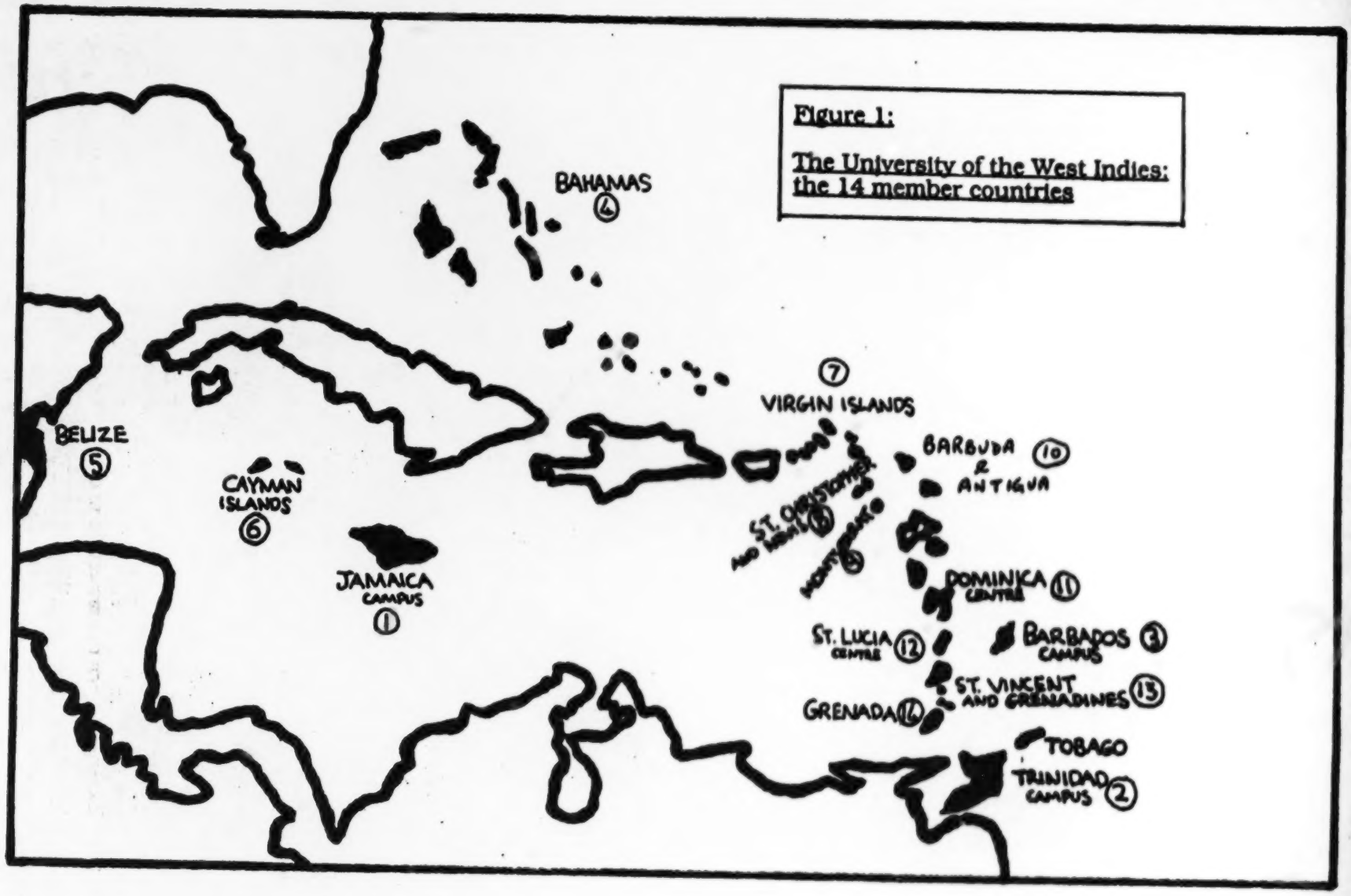

Figure 1:

The University of the West Indies: the 14 member countries

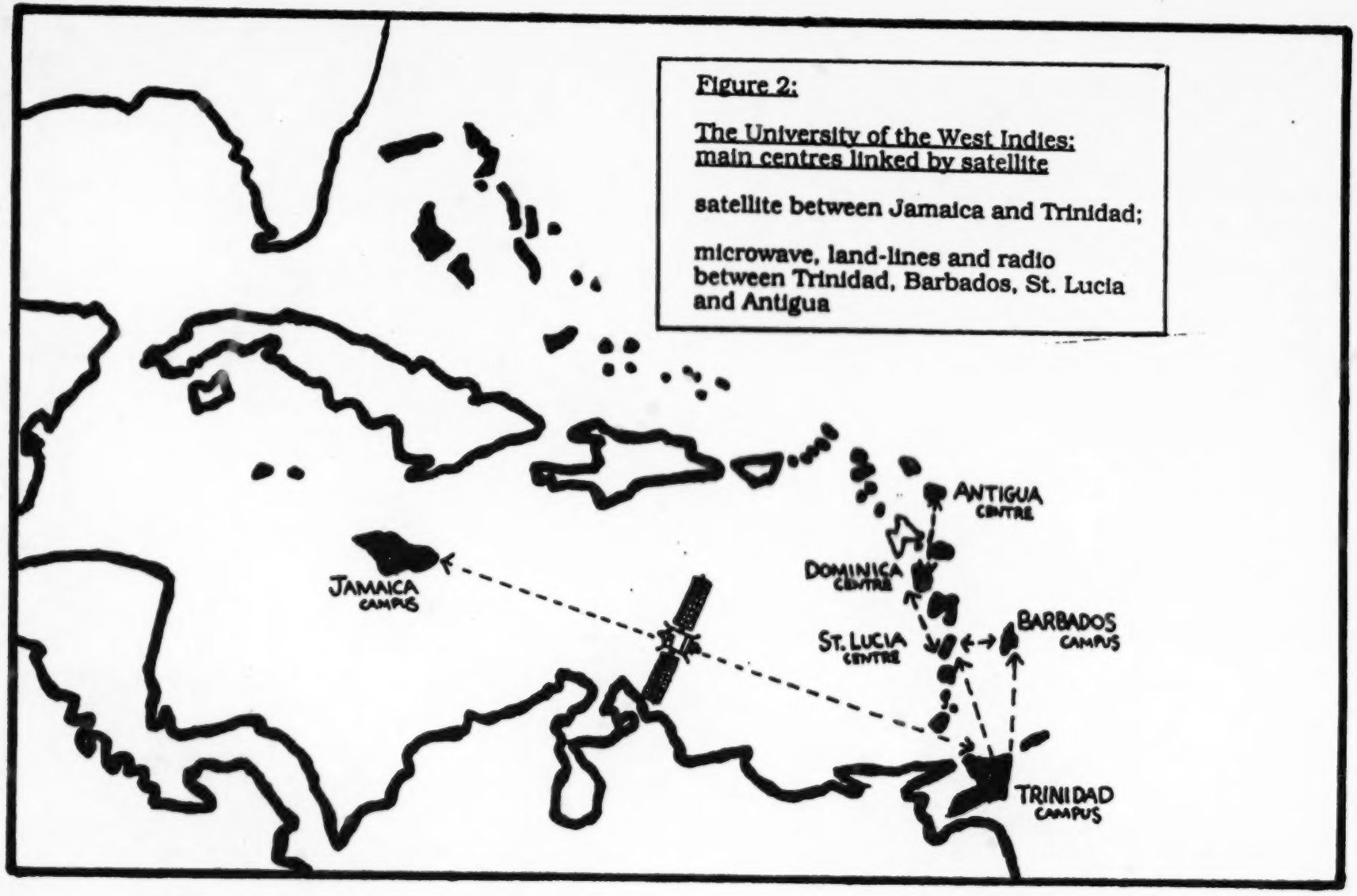

Figure 2:

The University of the West Indies:
main centres linked by satellite

satellite between Jamaica and Trinidad;

microwave, land-lines and radio
between Trinidad, Barbados, St. Lucia
and Antigua

telephone. The report recommended in 1982 a five-year pilot satellite project, in conjunction with the development of other media such as print and A/V material. The Ministers of Education and Health from the 14 countries accepted the main recommendations, and with the assistance of external funding, the University of the West Indies Distance Teaching Experiment (UWIDITE) was implemented in March, 1983.

4. Target groups and main educational objectives

While there has been a steady increase in the numbers of students coming in to the University of the West Indies since its inception, only the best qualified students are admitted. Furthermore, student admissions from the smaller or less developed islands actually dropped between 1971 to 1979, probably due to the high cost of travelling to the three main campuses, and living away from home. To counter this, UWI set up the Challenge Examination project, which allowed students to study the first-year courses in their own country. However, there are still major financial barriers for those who then want to continue their studies at one of the three main campuses. Thirdly there is a shortage in most of the 14 countries of appropriately trained manpower, especially in education. Communications technology, and particularly the use of telephone and satellite facilities for teleconferencing, were seen as a possible solution to these problems.

The main objectives of UWIDITE are as follows:

1. to demonstrate the use of teleconferencing in education and public service throughout the region and to familiarise the university and the communities with the technology
2. to measure the actual level of demand for such a service
3. to develop experience in distance education methodology and techniques
4. to investigate the effect of distance education on other UWI activities
5. to examine the feasibility of developing local facilities in different countries
6. to examine what other regional organisations might benefit from the system
7. to examine the financial viability of a permanent service.

The main target groups are students scattered across the islands wishing to study the same course, professionals requiring up-dating, and university administrators requiring communication between sites.

5. Programming

Programmes in 1984 began at 9.30 a.m. and went through to 9.00 p.m., Monday to Friday, using a total of about 40 hours a week of transmission time. By 1987, this had increased to 50 hours a week.

The main use of the system has been to provide first year courses for Challenge students, non-credit courses, and teleconferences (March, 1983):

a. Student courses

i. Courses leading to UWI qualifications:

- 3 Certificate of Education courses (one year full-time - 15 months via UWIDITE)
- 5 first year social science courses
- 1 Certificate in Public Administration course
- 12 law tutorials for Challenge students

ii. Courses not leading to UWI qualifications

- 1 course in continuing medical education in reproductive health

iii. Outreach programmes

- technician upgrading
- nutrition for community workers
- training for day care personnel
- radiation protection

b. Teleconferences

i. Medical consultations

ii. University meetings

iii. Administrative

iv. Professional/academic development

6. Distribution System

The original intention was to use small, inexpensive ground stations, each of which would communicate directly with each other. However, this did not prove possible because of limited funds, and the lack of a non-commercial satellite that could be used. It was therefore necessary to use commercial carriers, which meant linking into the national PTT system.

Each teleconference centre is linked to the appropriate international gateway via leased four-wire telephone lines. Jamaica is linked to the Eastern Caribbean countries by the INTELSAT satellite via Trinidad, from where the signal is relayed by microwave to the system 'bridge' at St. Lucia. The Eastern Caribbean countries are linked by a mixture of microwave, UHF radio and tropospheric scatter. There is an eighth centre at Montego Bay, Jamaica, which is linked by ordinary telephone line from Mona.

Grenada joined on October 1st, 1987, and three new island sites are expected to join in 1988. There will also be three more rural sites in Jamaica which will use radio. These sites will also be inter-active.

7. Production

60 per cent of UWIDITE usage is devoted to teaching, 15% to university administration and 25%

to internal UWIDITE management and training. The majority of programming is either teleconference meetings or 'live' lectures. While the bulk of the teaching is done by interactive audio, the main teaching materials are print. No full motion video is broadcast, but video tapes are used in certain courses.

In 1987, there were seven transmit and receive sites: one on each of the three campuses (Mona, St. Augustine, Cave Hill) and one at each of the University centres in Antigua, Dominica, Grenada and St. Lucia (see Figure 2). Seven dedicated teleconferencing rooms have been equipped with microphones, speakers, a convenor, switiching facilities, and a scrambler. Each site also has slow-scan television and a telewriter for on-line communication, and an IBM PC for document transmission.

Audio quality compares favourably with the normal telephone service, but there are many breakdowns and problems. The system has a 90% technical reliability (Tietjen, 1987), but when breakdowns do occur they have serious consequences. The weakest links are the land-lines in Trinidad and Jamaica. Because of the problems, the carriers instituted a regular monthly system-wide check, which improved services considerably. Nevertheless Lalor and Marrett (1987) conclude that the use of small ground-stations instead of telephone lines at each site would be much more satisfactory. Slow-scan television (with the signal converted to an audio tone) has proved to be very popular with UWIDITE and relatively trouble-free, allowing for transmission of pictures of both tutors and students, and pre-prepared visual aids. However, it is not possible to transmit both a voice and graphics signal *simulataneously* through the system. It is also quite slow, taking between 17 seconds and a minute for a single video frame to be transmitted. The telewriters have been troublesonme to use. Computerised document transmission has worked well when manually operated, although there have been problems with automatic transmission at night. Tutor attendance has been excellent, with few cancellations, and the tutors and students have usually persevered even when there have been noisy lines and troublesome equipment. The aim is for a tutorial style, but varies from tutor to tutor.

In addition to the on-line facilities, there are video cassette replay facilities in each centre. There is a Learning Resource Centre at Mona with some video production facilities. Print material has been written, in the main, by the course tutors; video material has been produced by UWIDITE staff and the University students with professional advisors.

The system is being used for about 50 hours weekly.

8. Ownership, regulation and management

The project is administered by the University of the West Indies, from Mona, under the direction of a Pro-Vice Chancellor, Professor Gerald Lalor. Staff are a little difficult to count because most are not full-time. There are six full-time staff, five of whom are in Jamaica, with a full-time secretary in Barbados. There are also part-time staff scattered across the various campuses and centres. There is an Advisory Committee, with representatives from each campus and the Extra Mural centres, as well as faculty representatives. Technical equipment on-campus at local centres is paid for and maintained by the University.

The various local and international carriers - Barbados Telephone Company, Jamaica Telephone Company, Trinidad and Tobago Telephone Company, Cable and Wireless, JAMINTEL, TEXTEL, and Barbados External Communication Limited - are responsible for the maintenance and performance of the communication channels. This multiplicity of carriers is not without its problems, and it is felt that working with a single main carrier would be better. However, there are no regulatory barriers to international linking. UWIDITE already links occasionally with United

States and Canadian institutions, although such use is not extensive.

The establishment of UWIDITE was considerably facilitated by technical assistance, both financial and in terms of consultancy and training, from USAID, and by a feasibility study (the Caribbean Regional Communications Study - CARCOST), also funded by USAID. Meetings of Caribbean Ministers of Education were used to provide political support and direction for the establishment of UWIDITE.

9. Patterns of communication

The basic pattern of communication is two-way audio, via leased telephone lines, and satellite, microwave and UHF radio communication via national and international carriers.

10. Audiences and utilisation

In 1984 there were approximately 400 students following courses through UWIDITE. Course size ranged from 14 to 68 with an average of 30 students per course across six sites. In a period of just over a year, from mid-1983 to end-1984, 29 courses used satellite tutorials. In the 27 month period from September 1984 to December 1986, over 2,000 students, tutors and administrators used the system, logging up a total of 5,385 hours of programming.

11. Costs

Initial funding

USAID gave US$330,000 for a feasibility study up to 1982, and a further US$600,000 from 1982-84 for UWIDITE salaries, travel and staff support; $220,000 for communications costs, and in addition the main items of equipment for the five sites, installation, technical assistance and training. £100,000 (sterling) has also been granted by the Commonwealth Association of Science, Technology and Mathematics Educators (CASTME). Financial support has also come from some Caribbean governments.

Capital costs

The approximate cost of an inter-island site is around US$30,000 for equipment, plus about US$10,000 for room adaptation.

Recurrent costs

The total recurrent cost for 1987/88 is Jamaican$1.946 million. These are direct costs and some 'hidden' costs have not been defined. The governments now provide almost all the recurrent costs. Student fees are very low but they pay the cost of print material. Some funding is obtained to cover the cost of special programmes, e.g. The International Labour Organisation, Pan American Health Organisation, CARICOM, Johns Hopkins Centre for International Education in Gynaecology and Obstetrics.

The 24-hour per day leasing rates for the UWIDITE network are US$221,000 a year. This breaks down as follows: land-lines: $8,000; satellite segment: $132,000; other international telecommunication costs: $81,000. The telecommunications lease represents about one-third of the total recurrent costs. These leasing costs are at commercial rates less 20%.

The additional recurrent cost for each new site is approximately US$30,000 per site per year. In 1984/85 the costs worked out at US$72 per hour, or roughly $2.5 per enrolled student per hour.

12. Planned duration of project.

USAID support ended in 1986 and the project is now on the University budget. It is no longer considered an experiment but an operational system (despite the title).

13. Evaluation findings

An American company, Abt Associates, was planning to carry out an independent evaluation, but no publication has yet been located. However, a full report, with detailed information about costs, technology, courses, and enrolments for the experimental period up to 1986 has been produced by Lalor and Marrett (1986), and USAI has published a series of reports on UWIDITE (see References below).

The project has managed to provide outreach facilities and courses for students on islands other than Jamaica, Trinidad and Barbados, and has improved communication between the three campuses and the three extra-mural centres, at a low cost per student. It has also proved valuable for professional development, particularly in agriculture and medicine. Lalor and Marrett estimate that on one programme alone (the Certificate in Education for teachers), the estimated savings over conventional provision covered the entire cost of the UWIDITE programme. At the same time, the UWIDITE education programme was successful in terms of the quality of student performances. the interest of the teaching staff, and student acceptance of the system. Students (92%) teachers (95%) and administrators (99%) found the audio-conferencing system easy to use, and 89% of students found UWIDITE courses interesting and 98% attended regularly. 68% believed they learned as much or more from UWIDITE courses as from face-to-face classes. Interaction between students and remote tutors was often considerable, sometimes considerably more so than in conventional provision.

One major limitation of the system is that there are only three 'off-campus' sites, and students must come to a local centre to participate. It is planned to extend the number of sites to more countries, to ensure that UWIDITE reaches rural communities. There is no intention currently to the use of FM radio to allow students to listen at home. Funding though is now more secure, as the costs are now being carried as an integral part of the University budget.

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I am grateful to Professor Gerald Lalor for providing information for this report, which also draws heavily on the following papers:

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